TIDAL WAVE
NOVAMETRIX CAPNOGRAPHY

HAND-HELD CAPNOGRAPHY MONITOR

Service Manual

Model 610

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Novametrix Medical Systems Inc.
PO Box 690
5 Technology Drive
Wallingford, Connecticut, U.S.A. 06492

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1-800-243-3444
In Connecticut, call Collect (203) 265-7701
FAX **(203) 284-0753**
http://www.novametrix.com
Email **techline@novametrix.com**

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D.R.M. Green
European Compliance Services Limited
Oakdene House
Oak Road
Watchfield
Swindon, Wilts SN6 8TD

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Section 1 *Safety*

The *TIDALWAVE* handneld capnograph is electrically isolated. Patient leakage current flowing from the instrument to ground is limited to less than 100 uA.

For maximum patient and operator safety, you must follow the following warnings and cautions.

WARNINGS

Indicates a potentially harmful condition that can lead to personal injury.

- **Explosion Hazard:** Do NOT use the monitor in the presence of flammable anesthetics. Use of this instrument in such an environment may present an explosion hazard.
- **Electrical Shock Hazard:** Always turn the monitor off and disconnect the external DC power source before cleaning it. Do NOT use a damaged sensor or one with a damaged cable. Refer servicing to qualified service personnel.
- **Failure of Operation:** If the monitor fails to respond as described, do not use it until the situation has been corrected by qualified personnel.
- Do not operate the monitor if it appears to have been damaged.
- Never sterilize or immerse the monitor in liquids.
- The monitor does not alert for NO RESPIRATION if the airway adapter is removed from the CAPNOSTAT CO_2 sensor.
- Do not position the CAPNOSTAT CO_2 sensor's cable in a manner that may cause entanglement or strangulation.
- Use the external battery charger in non-patient areas only.
- Do not apply tension to the sensor cable.

CAUTIONS

Indicates a condition that may lead to equipment damage or malfunction.

- Federal (USA) law restricts this device to sale by or on the order of a licensed medical practitioner.
- Use only a Novametrix approved power supply. Use of any other power supply may damage the Tidal Wave and void the warranty.
- The Tidal Wave is not intended to be used as a primary diagnostic apnea monitor and/or recording device.
- Refer servicing to qualified personnel.
- Never sterilize or immerse the monitor in liquids.
- Do not sterilize or immerse the sensor except as directed in this manual.
- Do not store the monitor or sensors at temperatures below 14° F (-10° C) or above 131° F (55° C).
- Do not operate the monitor or sensor at temperatures below 32° F (0° C) or above 104° F (40° C).
- Where electromagnetic devices (i.e., electrocautery) are used, patient monitoring may be interrupted due to electromagnetic interference. Electromagnetic fields up to 3 V/m will not adversely affect system performance.

NOTES

Indicates points of particular interest or emphasis for more efficient or convenient operation.

- The Tidal Wave monitor is intended for operation with Novametrix Single Patient Use airway adapters.
- Certain rebreathing circuits, or the presence of artifact such as cardiogenic oscillations, may cause the monitor to react to non-respiratory CO_2 fluctuations as if they were breaths. This condition affects only the RESP (respiration) numeric values on the display.
- Refer to the User's Manual (Cat. No. 6700-23) foradditional operational information.
- Operating the TIDAL WAVE below 50° F (10° C) will result in longer warm-up time and reduce battery life.
- Components of this product and its associated accessories which have patient contact are free of latex.

Section 2 *Introduction*

The TIDAL WAVE hand-held capnograph from Novametrix is designed to monitor CO_2 whenever capnography is required. The monitor combines full graphics capabilities, a no-respiration alert and rugged CAPNOSTAT CO_2 sensor technology.

2.1 Indication for use

The TIDAL WAVE capnograph is a hand-held non-invasive CO_2 monitor specifically designed for short term monitoring during transport, emergency, anesthesia, post anesthesia recovery, respiratory care and intensive care.

2.2 Operational Overview

KEYS AND INDICATORS		
Key	Operator Action	Function
1	Press	Switches power on/off. Capnogram available immediately after self test, fully operational in 60 seconds.
2	Press	Selects Capnogram (waveform) or trend display.
3	Press	Silences audible alerts for two minutes. Press again to deactivate. Also resets (cancels) audio if pressed during an active alert (audio will not alert for the duration of the NO RESPIRATION event that was silenced).
	Press and hold for 2 seconds	Silences audible alerts until the key is pressed again and held. This function is reset upon the next power-up.
	NOTE: -Refer to alert indicator below. -Key inactive if audio disabled in configuration menu. -The monitor may be factory configured as to not allow the audio off function (two minute silence is still available).	
4	Press	Sets display back light off/on.
	Press and hold	Changes contrast/viewing angle of display (changes one step every second).
5 NEO	Press, then follow screen instructions	Change application mode: adult/pediatric or neonatal airway adapter use.
Press and hold NEO, then press ☼ before releasing NEO		Displays CONFIGURATION screen (Select compensation for N_2O and high O_2, CO_2 scales, etc.).

Indicators	Function/Meaning
A	Green; battery is fully charged. Slow flashing yellow; battery power is low. Fast flashing red; battery is exhausted (10 - 15 minutes monitor time left).
B	Illuminated when "external" power is connected.
C	Steady yellow: audio silenced for 2 min., no alert in progress. Flashing yellow: audio silenced (no alert in progress). Flashing red and yellow: alert in progress; audio is off or 2 minute silence.
D	Illuminates when in NEO mode (see #5 above).

Icons	Function/Meaning
	Audible alert silenced for two minutes.
	Breath bar. Gives real time indication of breaths.
	Status indicator. Numbers 1-8 indicate specific conditions.
	Neonatal icon. Used to indicate neonatal mode selected.
	Adult icon. Used to indicate pediatric/adult mode selected.
	Exit CONFIGURATION or time/date screen.
	Set time/date. Press ☼ from CONFIGURATION screen to set time/date.
	Indicates back light key.
	Trend screen icon. Displayed in Trend screen.
	Sensor not up to temperature icon. Displayed when performing an adapter zero and the sensor is not at operating temperature.
	Breaths detected icon. Displayed when performing an adapter zero and the monitor detects breaths.

2.2.1 Configuration Menu

A CONFIGURATION menu is provided on the TIDAL WAVE in order to allow customizing of various settings. To access the CONFIGURATION menu, press and hold the NEO (NEO) key, then, simultaneously press and hold the Backlight ☼ key until the CONFIGURATION screen is displayed. The grid on the screen corresponds to the following chart, which indicates the available selections:

Gas Compen-sation	Waveform Scale	Waveform Speed	NO RESP Time	CO_2 Units	Alert Volume	RS232 Interface	Waveform Fill
1	2	3	4	5	6	7	8
***Room air**	Small	Slow	***20 seconds**	***mmHg**	Disabled	***NovaCOM**	***Unfilled**
O_2 >60%	***Medium**	***Medium**	40 seconds	kPa	*Low	Reserved	Filled
N_2O >60% balance O_2	Large	Fast	60 seconds	%	***High**	-	-

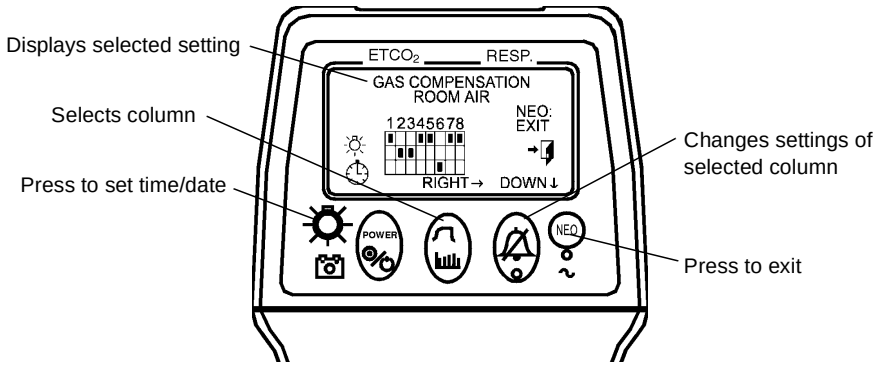
*-default settings

Changing CONFIGURATION settings:

Press the Waveform key to select among columns 1 through 8 (Gas comp., Waveform scale, etc.).

Press the Alert key to change the setting of the selected column.

Press the NEO key to exit the CONFIGURATION menu and return to normal monitoring mode (selections will be saved).



NOTE

When formatting, the selected column is described on the first line of the text at the top of the screen. A flashing, filled box indicates the current setting. The setting is described on the second line of text at the top of the screen.

If CO_2 units are attempted to be changed after data has been collected a message warning that trend memory will be erased is displayed. To change units and erase trends press the key a second time.

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Section 3 Theory of Operation

The TIDAL WAVE is a microprocessor-based handheld instrument that measures the clinical parameters of CO_2 production and respiration rate. The system contains all the circuitry necessary for displaying patient information gathered from the CAPNOSTAT® sensor. The theory of operation of the TIDAL WAVE is explained in detail in the subsections that follow.

3.1 2738 Main Board

For circuit diagrams of the digital section described below, refer to sheet 1 of the Main Board (2738-03) schematics. Embedded control for the system is provided by IC1, a Motorola MC68332 integrated microcontroller. In addition to a full 32-bit Central Processing Unit (CPU), this device also contains circuitry for system clock generation, peripheral chip select generation, data control, interrupt generation, a sophisticated timing co-processor, synchronous and asynchronous serial communication. In general, functional signals are grouped together into ports, and each signal can be independently programmed by software to be its pre-defined port function or as discrete I/O. Additionally, the functionality for several ports (Port C, E and F) can be pre-defined by the state of the data bus on system power-up. A special "background mode" port allows the device to be controlled by an external source for system debugging and testing. Also integrated on-chip are several activity monitors, as well as a software watchdog to ensure proper device and system operation. Refer to Table 1.

Table 1. CPU Port Functions

Port	Defined Function	Functionality Control, Data Bus Control (Alt Functions: D pulled low)
TPU 16 Channels	Timing Signal Generation	Each channel independently user programmable as TPU function or as Discrete I/O
QSM 4 Synchronous Serial Chip Selects & one asynchronous serial channel	Serial Communications Port: QSPI: Queued Serial Peripheral Interface SCI: Serial Communications Interface	QSPI chip selects independently user programmable, can be used as Discrete I/O or decoded to create up to 16 chip selects. SCI transmit can be programmed as Discrete I/O
Background Mode	System debugging	Allows an appropriate external device to control the microprocessor and system
C	Chip Selects	D0: CSBOOT* Data Width, 8 or 16-bit D1: CS0*-CS3* or BR*,BG*,BGACK* D2: CS3*-CS5* or FC0-FC2 D3-D7: CS6*-CS10* or A19-A23
E	Bus Control	D8: Control Signals or Discrete I/O
F	MODCK and Interrupts	D9: MODCK & IRQ or Discrete I/O

The maximum operating frequency of the integrated processor is 16.78 MHz. The operating frequency is software selectable and generated by an internal VCO operating from Y1, a 32.768KHz watch crystal. The Timing Processor Unit (TPU) co-processor of the MC68332 provides timing generation derived from the system clock. This feature is utilized to control the precise timing required for the acquisition of the End Tidal Carbon Dioxide ($etCO_2$) signals. The TPU is also use to generate the PWM (pulse Width Modulation) control for the CAPNOSTAT case and detector heaters, generate clock output for the LED backlight, monitor keypanel input, generate the DAC load pulse, as well as provide the frequency generation for the audio tones. See Table 2.

Table 2. TPU Timing Generation for the $etCO_2$ subsystem

Signal	Name	Function / Timing
CO2AZ	Auto Zero	Clears the Sample/Hold circuitry prior to data acquisition. Active High, 90 us
CO2PWENB	Pulse Width Enable	Defines the active time for both phases of the bipolar source pulse, used for pulse width protection circuitry. Active High, 830 us
SRCDRV0	Source Drive 0	First source drive signal. Active High, 405 us
CS*/H	Current Sample/Hold	Enables circuitry for source current measurement. Sample is taken when SRCDRV0 is active. Low = Sample, 90 us, High = Hold
SRCDRV1	Source Drive 1	Second source drive signal delayed for 30 microseconds after SRCDRV0 ends. Active High, 395 us
SS*/H	Signal Sample/Hold	Enables circuitry for CO_2 and Reference channel data acquisition. Low = Sample, 90 us, High = Hold
CASEPWM	Case Heater PWM	PWM control for the case heater servo
DETPWM	Detector Heater PWM	PWM control for the detector heater servo
SW1 - SW4	Switch1 through Switch4	Membrane keypanel input
TOUT1	Tone Generation	Variable frequency outputs to generate system audio
BACKLITE	LED Backlight	2kHz Frequency generated to modulate the backlight in order to reduce power consumption.
DACLD*	D-A Load Pulse	When asserted, all 4 channels of the DAC latches are simultaneously updated with the contents of the input latches.

Ferrite and L-C filters and 100pF capacitors have been placed on selected microprocessor signals with fast rise and fall times (including timing, clock, and address lines) in order to help reduce and suppress the radiation of electro-magnetic interference (L1-L6, & C154-C159). In addition, good EMI/EMC design techniques have been incorporated in the component layout and printed circuitboard manufacture.

Table 3 lists the chip select, control and discrete I/O functions for the TIDAL WAVE system module. On power-up, Ports E and F are programmed as discrete inputs by pulling down their controlling data lines, DB8 and DB9. After power-up, the software sets up each pin function individually and performs a series of self tests to check the integrity of the system. The state of configuration inputs on Port E (TST*, CNEG0*, CNEG1* and JP0*) are read. These inputs allow the software to identify different operating states such as Test Mode, or different hardware configurations. After the initialization period is complete

and all system functions have been set, the LED output toggles at a 1Hz rate switching transistor Q3 which drives the status LED D3, indicating that the system is ready for operation.

Table 3. Chip Select, Control and Discrete I/O

Port	Pin Functions	System Signal Name	I/O	Comments
C				D0 pulled low, D1-D7 pulled high, Pins are Chip Select on power-up
	CSBOOT**	BOOTCS*	O	Program PROM Chip Select Byte wide mode, (8-bits) D0 = LOW
	CS0* / PC0 / BR*	SRAMWR*	O	SRAM Write Enable
	CS1*/ PC1 / BG*	TP15	O	Test Point Available For Expansion Or De-bugging
	CS2* / PC2 / BGACK*	SRAMRD*	O	SRAM Read Enable, Byte Mode
	CS3* / PC3 / FC0	ROMWR*	O	FLASH PROM Write Enable, Byte Mode
	CS4* / PC4 / FC1	DISPCS1*	O	LCD Chip select #1
	CS5* / PC5 / FC2	DISPCS2*	O	LCD Chip select #2
	CS6* / PC6 / A19	LEDCS*	O	Chip select for front panel LEDs
	CS7* / PC7 / A20	RTCCS*	O	Real Time Clock Chip Select
	CS8* / PC8 / A21	ROMWREN	O	Port C Discrete Output, prevents unintentional writes to FLASH EPROM. This signal must be asserted before ROMWR* in order to overwrite the flash.
	CS9* / PC9 / A22	PROFILE*	O	Enables software profiling data output latch
	CS10* / ECLK / A23	ECLK	O	Enable Clock for the Liquid Crystal Display
E				D8 pulled low, Discrete I/O on power-up
	DSACK0* / Port E0	TST*	I	Initiate System TEST if Low
	DSACK1* / Port E1	DS1*	I	Data and Size Acknowledge 1*
	AVC* / Port E2	CNFG0*	I	Configuration Switch 0
	RMC* / Port E3	CNFG1*	I	Configuration Switch 1
	DS* / Port E4	DS*	O	Data Strobe
	AS* / Port E5	AS*	O	Address Strobe
	SIZ0* / Port E6	JP0*	I	Hardware Jumper Mode Select 0
	SIZ1* / Port E7	JP1*	I	Hardware Jumper Mode Select 1
	R/W*	RD*	O	Data Read Strobe
		WR*	O	Data Write Strobe

Table 3. Chip Select, Control and Discrete I/O				
Port	**Pin Functions**	**System Signal Name**	**I/O**	**Comments**
F				D9 pulled low, Discrete I/O on power-up
	MODCK / Port F0	LED	O	LED CPU Activity Indicator
	IRQ1* / Port F1	AUD_EN	O	Audio Enable Signal
	IRQ2* / Port F2	CASEOT	O	Case Heater Over Temperature Shut Down
	IRQ3* / Port F3	DETOT	O	Detector Heater Over Temperature Shut Down
	IRQ4* / Port F4	EXTDCIN	I	Indicates external AC MAINS power operation
	IRQ5* / Port F5	PWRKEY	I	Power Key Status Input
	IRQ6* / Port F6		I/O	Spare I/O
	IRQ7* / Port F7	NMI	I	Non-Maskable Interrupt

3.1.1 System Memory

An 8-bit wide data path is used for FLASH PROM and SRAM transfers. Program code storage is contained in a 1-Meg 5V FLASH or EEPROM (IC3) device. The FLASH PROM is protected from unintentional overwrites of the program code by transistor Q1 and the ROMWREN signal. The ROMWREN line must be high prior to writing new code into the FLASH devices. Volatile data storage is contained in the SRAM (IC4). The SRAM is powered by a 2.5 Volt level (VBACK) when main power is removed from the system. This allows non-volatile data storage when the monitor is off. Capacitors C149 and C150 retain the data for approximately one minute during quick battery changes. During the battery back-up state, transistor Q2 keeps the CS1* control of the SRAM in the inactive state. This forces the data bus to a high impedance state, isolating the SRAM from the rest of the system. True non-volatile storage for system parameters is provided by a serial EEPROM (IC2).

3.1.2 Serial Communications

Reference page 6 on schematic.

The on-chip asynchronous serial communications interface (SCI) channel is contained in the MC68332. The signals are level shifted to standard RS232 levels by IC29 which is a Dual RS232 Communications Driver/Receiver. The transmitters in the RS232 level shifter are under software control to minimize the patient leakage current to the rear panel connector J101 when communication is not being used. The signal COMMPWR controls the transmitters operation and is derived from IC11 pin 14 (schematic page 2). The serial connection to external nonpatient contact devices is electrically isolated from the patient through the CAPNOSTAT airway adapter. Connector J101 is designed to interface with external devices when placed in the base station. There is a 4 pin connector (J403) available for test and service which offers an internal connection to the RS232 communications. The data signals ASRxD and ASTxD are

logic level signals and are diode protected against over voltage by D38 and D35 should IC29 breakdown from ESD. Refer to the table below for the pinout of J101.

Table 4: Power/Communications 6-pin modular connector J101 (rear panel).

Pin Number	Signal	Function
1	RxD	Internal MC68332 UART Receive, RS232 Signal, Level Shifted
2	TxD	Internal MC68332 UART Transmit, RS232 Signal, Level Shifted
3	DGND	Digital Ground
4	DGND	Digital Ground
5		
6	+VCHG	External DC input supply to power unit and battery charger

3.1.3 User Interface Control Circuitry

Refer to schematic page 2.

The user interface features a 64 row by 128 column Liquid Crystal Display (LCD) module with an LED backlight. Patient and system information is presented in both graphical and textual formats organized to fit into a few simple screen configurations. A 5-switch membrane keypanel is provided for operator entry of screen selection, calibration, adapter selection, display control, unit power, and user configuration. The user interface also contains four LEDs which represent various system conditions, such as input power status (AC or Battery), adapter mode selection and alarm state. Control of the user interface is provided by the LEDCS* chip select signal together with the TPU input signals from the microprocessor. TP9 thru TP12 (SW1-SW4 respectively) are input buffers which read in the present state of the membrane keys. Depressing a key causes the signal line to be pulled low in contrast to its normally high state. IC11 provides a latched output for controlling the status LEDs. The LCD backlight is a series of LEDs which are driven by the TPU (BACKLITE) signal in order to lower the LCD backlight power requirement and is activated by the backlight membrane key. The BACKLITE signal is a 2kHz logic level signal generated by TP14 which modulates the LED backlight through FET switch Q5. This signal is capacitively coupled by C30 in order to prevent the backlight from remaining on in the event of a system failure. Reference page 6 on schematic. Contrast control for the LCD is provided by DAC IC36 and amplifiers IC45A and IC35B. When the CPU detects a press and hold of the backlight membrane key, the CPU sends a digital ramp input to the DAC which causes the its output to change accordingly. Inverting amplifier IC35B controls the base current into transistor Q18, which changes the level of the display contrast voltage, VDISP.

Refer to schematic page 6.

An audio frequency tone is generated by the TPU processor of the MC68332 (TOUT1). This signal is fed into the reference input of the 8-bit DAC IC36, providing a means for attenuating the signal under CPU control. From the DAC, the signal (TOUT) is amplified by IC35A and Q4 which drives the system speaker (LS1) to produce system audio. The audible signal can be disabled by the AUD-EN line. When AUD-EN is high, Q22 will be on, effectively grounding the input to IC35A, preventing any audible signal from sounding.

3.2 Real Time Clock, Power on RESET Generation and Glue Logic

Reference sheet 2 on schematic.

Timekeeping for date, and time stamping of patient trend information, is provided by IC9. This device contains a built-in crystal for precise time and date measurement. In the absence of digital power, the timekeeping function is maintained by the battery backed-up supply, VBACKUP.

On power-up, the system is forced into a "Reset" state by IC6 (Sheet 1). When the supply voltage VDD, attains a value approaching 1V, the SRST* line is asserted to prevent undefined operation. IC6 also provides supervision over the VDD logic supply. If the logic supply falls below 4.55V ±120mV then IC6 generates a reset condition until the supply returns to a safe level. Inverter IC5 is used to generate the active high RESET signal.

The TIDAL WAVE makes use of the high level of integration offered by the MC68332. Therefore, the glue logic required is a minimum. Chip selection for the serial peripherals is provided by the queued serial module (QSM) (PCS0-PCS3) of the microprocessor IC1 while parallel interface peripherals are selected by the internal chip select registers of Port C (BOOTCS* and CS0*:CS10*) (see schematic sheet 1).

3.3 CO_2 System Analog Subsections

3.3.1 CO2 Pulser Source Drive

Refer to schematic page 3 and Table 2 of this document.

The source drive circuitry is designed to drive the source with a bipolar signal to prevent the migration of charges within the source that may result from unidirectional electrical fields. The resistance of the source is monitored constantly to ensure the integrity of the system by sampling the current through the source while it is active.

The signals for the source drive are generated by the TPU co-processor in the MC68332, IC1. The SRCDRV0 and SRCDRV1 lines are used to control the bipolar signal that drives the source. The SRCDRV0 signal goes High as soon as the CO2AZ (Auto Zero) line goes Low and the CO2PWENB (Pulse Width Enable) line goes High. The duration of SRCDRV0 is 405 us (micro-seconds), and drives the source in the positive direction. The SRCDRV1 line drives the source with an opposite polarity signal when High for the same duration. There is a 30 us delay from the time the SRCDRV0 line goes Low to when the SCRDRV1 line goes High. This delay is to prevent the possibility of both SRCDRV0 and SRCDRV1 being active at the same time, thus creating a low impedance path between the two supplies.

When SRCDRV0 and CO2INH (Inhibit) are High, the output of MOSFET Driver IC14A pin 7 will go Low. This turns the P-Channel half of MOSFET Q6 on. At the same time, the output of MOSFET Driver IC15B pin 6 will be High, biasing on the N-Channel half of MOSFET Q7 on. With both Q6B P-Channel and Q7A N-Channel on, current will flow from +VSRC through Q6B to the positive source terminal, then back from the source negative terminal through Q7A, through R110 to -VSRC. When SRCDRV0 returns Low, both Q6B and Q7A are turned off and no current flows through the source. After the 30 us delay, SRCDRV1 will go High. The output of IC15A pin 8 will go High, biasing the N-Channel section of MOSFET Q6 on. The output of IC14B pin 5 will go Low, turning the P-Channel of Q7 on. Current will now flow from +VSRC through Q7B to the source negative terminal, back from the source positive terminal through Q6A and R110 to -VSRC. Current will cease to flow when SRCDRV1 goes Low. The bridge circuit of Q6 and Q7 in effect switches the polarity of the drive signal of the source between +VSRC and -VSRC. CO2PWENB also falls with the falling edge of SCRDRV1, signaling the end of source activity.

When current flows through the source, it will also flow through current sensing resistor R110, creating a differential voltage proportional to the source current:

$V_{SRC} = (V_{SR} / R_{SR}) * R_S * A_{V(DA)}$ where V_{SRC} = voltage out of difference amplifier proportional to current through the source element

= 24V +/- 0.625V

V_{SR} = differential voltage across the source element

R_{SR} = resistance of the source element

R_S = resistance of the current sensing resistor

= 1 ohm

$A_{V(DA)}$ = difference amplifier gain

= 5

$V_{SRC} = [120 \text{ (Volts*Ohms)} / R_{SR}]$

The voltage signal out of difference amplifier IC16B is level shifted through C36 and fed to the sample and hold IC17A. A low level on the CS*/H (Current Sample and Hold) signal allows the source current signal to be sampled. On the rising edge of CS*/H, the present voltage level of the source current signal is held and appears at the input to channel A2 of the Analog to Digital Converter IC8 for processing by the MPU. When CO2AZ is High, the input to the sample and hold of IC17A is grounded to discharge any residual charge that may be on C36. This clears the sample and hold output for the next measurement.

In order to prevent the source from being driven until the system is up and ready, protection circuitry inhibits the source drive until enabled. During system power-up, the RESET line keeps Q8 on. This causes the CO2INH line to be brought Low, preventing source pulses by pulling down SRCDRV0 and SCRDRV1 through D8. Protection circuitry also guards against extended pulse width as well as shortened duty cycle. On the rising edge of CO2PWENB, the trip point of IC18B is exceeded, allowing C39 to charge through R114. If the SRCDRV signals do not turn the Source Pulser off within 200 us after the 830 us pulse period, the trip point for IC18A will be exceeded, pulling the CO2INH line low, turning the Pulser off. After the CO2PWENB signal returns Low, capacitor C41 discharges through R115, keeping the output of comparator IC18B at the voltage acquired by C39. After approximately 10.4 ms, C41 will have discharged below the comparator trip point. The comparator output goes low, discharging C39 and the circuit is ready for the next source pulse cycle.

3.4 CAPNOSTAT Case and Detector Heater Control

Refer to schematic page 4.

The temperature of the system directly affects its ability to accurately measure CO_2 and therefore must be precisely maintained at a controlled value. Two separate heaters and control circuitry are used; one regulates the temperature of the detectors for the CO_2 Data and Reference channels; the other regulates the temperature of the transducer case (and loosely maintains the temperature of the airway adapter). While the purpose of the Detector heater is to keep the detectors' sensitivity to infrared radiation constant, the function of the Case heater is to keep condensation from forming on the airway windows by elevating the window temperature above the ambient airway temperature. Both heaters use an efficient Pulse-Width Modulation scheme designed to decrease power consumption, with the PWM timing generated by the TPU under microprocessor control. This control loop is run by the CPU which does the calculations passes the duty cycle to the TPU. For the purpose of describing the regulation loop, the case heater circuitry will be considered. The detector and case heater circuitry are identical.

Inside the CAPNOSTAT, a sensing thermistor is thermally connected to the heater module. Initially, the CAPNOSTAT is at the ambient temperature and the resistance of the thermistor is large. A small current flows through the signal path CASETHERM and only a small voltage is developed across R131. The microprocessor programs the TPU to allow a maximum duty cycle of 90% to power the PWM heater circuitry. This causes the heater control MOSFET Q13A to be pulsed on and off with a duty cycle that is under direct control of the program software. As the heater warms up the case, the thermistor's resistance decreases, raising the voltage appearing at the input of the control loop. As described below, the MPU looks at this output voltage and decreases the duty cycle of the PWM control circuitry, gradually reducing the power output into the heater. When the desired temperature set point is reached, a balance is struck between the energy delivered into the system and the heat flow out of the system.

The case thermistor is sensed by amplifier IC20A pin 3. The difference between the signal at the non-inverting input and the reference appearing at the inverting terminal generates an error voltage proportional to the sensed temperature at the amplifier's output:

$$e_o\,(V) = [83.133V / (R_{th}+3.32K)] - 10.2V$$

where e_o = amplifier output voltage

R_{th} = resistance of the thermistor

= 4.36933K at 45°C

$$\text{Temp}\,(°C) = 4.1288\,(°C/V) * e_{o\,(T)}\,V + 41.7321°C$$

where e_o = amplifier output voltage at temperature T

This error voltage is low pass filtered by amplifier IC19A, sent to the ADC and processed by the CPU to regulate the output pulses from the TPU. The TPU PWM signal is buffered by MOSFET Driver IC22B and capacitively coupled to the gate of the heater drive MOSFET, Q13A. Capacitive coupling the signal prevents a system fault that would allow the PWM to be stuck at a level that would cause too high of a heater output. In the absence of a pulse, the gate drive will be pulled high, disabling the output to the heater. The pulsed voltage signal out of the MOSFET is filtered by D15, L7, C52 and C54 to produce a DC output level for the heater. Since the TPU generated PWM signal is based on the system clock, it is synchronized with the generation of the source pulse timing. This minimizes the effect of any random disturbance caused by the heater circuit on the detection of the CO_2 Data and Reference signals.

The error voltage out of amplifier IC20A also appears at the temperature watchdog comparator IC21A. If the error voltage reaches a voltage equivalent to 56 degrees Celsius, the comparator trips, turning Q11 off. The gate of MOSFET Q10A is pulled high by R130, which turns it off and VHTR is prevented from reaching the Source of transistor Q13A. The temperature of the sensor is also monitored by the MPU which will disable the heater when a temperature of 50 degrees Celsius is exceeded. To shut off the heater, the MPU asserts the CASEOT signal, turning Q12 on which turns Q11 and Q10A off, which in turn shuts Q13A off.

3.5 CO2 Input Signal Path

Refer to schematic page 5.

The signals from the sensor CO2DATAIN (CO_2 Data) and CO2REFIN (Reference Signal) have similar signal paths. The CO2DATAIN passes through a high pass filter with a gain of 3.8 consisting of C70, R164 and buffer amplifier IC25B. The signal is fed to a Butterworth low pass filter IC24B and associated components. This filter has a gain of 2 with a corner frequency of 1.5 KHz. The output from the low pass filter is fed to a 12-bit digital to analog converter IC36 (refer to sheet 6). The signal, CO2DIN comes into the reference of the DAC, which acts as a programmable gain stage followed internally by an amplifier with a fixed gain of 2. Here under processor control, the signal's gain is adjusted to an acceptable level for conversion. The gain setting is adjusted using the digitized signal out of IC8 as part of the feedback loop. Similarly, CO2REFIN is conditioned by high pass filter IC25A with a gain of 1.75 and low pass filter IC24A with a gain of 2. The equivalent fixed gains for the two input signals are not equal in order to compensate for differences in the output signal levels of the infra-red detectors in the CAPNOSTAT.

The output from IC36, CO2DOUT, is buffered by IC27A and AC coupled through C139 to IC44B. The CO2DATA signal received from the CAPNOSTAT is AC coupled prior to the high pass filter to remove any DC bias by C70. Prior to sampling CO_2 signal, the CO2AZ (Auto Zero) pulse biases Q16 on causing any residual charge on C139 to discharge to ground. At the start of the source pulse, the CO2AZ pulse goes Low and the CO_2 signal from the sensor is attained, and appears at the input of the sample and hold amplifier, IC17B. Near the end of the source pulse, the SS*/H (Signal Sample and Hold) goes Low and the peak signal is acquired on the internal sample and hold capacitor. SS*/H returns high at the end of the cycle, and the CO_2 signal on the sample capacitor is held at the peak value. The signal then passes through a low pass filter of R181 and C78 before being converted by the ADC into digital data and analyzed by the processor. The signal CO2REF follows an identical zeroing and acquisition path.

3.6 CAPNOSTAT Interface

(Refer to schematics 2738 sheet 5 and 2737 sheet 1)

Twenty pins of 60 pin connector J404 interfaces the CAPNOSTAT with the system electronics. Ferrite and L-C filters have been placed on all lines to suppress radiated EMI and reduce susceptibility from external sources of interference.

3.6.1 Barometric Pressure Circuitry

(Refer to schematic sheet 6)

IC34 is a piezoresistive differential pressure transducer with port P2 held as close to 0 psi (a perfect vacuum) as is possible. It measures the absolute pressure difference at port P1 relative to the vacuum at port P2. The transducer is calibrated for a full scale output of 0 to 15 psi, has internal temperature compensation and is designed to be driven by a constant current source. An on-board calibration resistor is trimmed by the manufacturer and is used to set the current through the sensing bridge by amplifier IC31B. Instrumentation amplifier (IA) IC33 conditions this signal to correspond to the current barometric pressure, which is set by adjusting VR1. The nominal gain of this amplifier is 93.56, which corresponds to an ADC count of 3800 at 760 mmHg. The output signal from IC33 is low pass filtered by IC31A and appears as an input (ABPRESS) to the 12-bit ADC.

3.7 Power Supply and Battery Charger

Supply and Reference Voltage Generation (refer to schematic sheet 7).

The monitor operates from either an isolated DC Mains power or from the internal Battery. There are two options presently for the internal battery, a Nickel Metal Hydride Battery Pack (NiMH), or a High Energy Lithium Cell Pack. The NiMH battery pack operates from a nominal voltage of 7.2V down to 6.0V while the Lithium pack operates from 10.5V down to 6.0V. This battery voltage range is monitored in hardware by IC37B and fed to the 12-bit ADC for level monitoring and comparator IC43B in order to shut the unit down at 6.0V. The NiMH battery can be charged either externally via a separate charger or internally when the DC input is connected and a NiMH battery is installed. The internal battery charging circuitry is located on the 2737-01 assembly and is described in a previous section of this document. The Lithium battery pack has a schottkey diode in series with the positive battery terminal to prevent accidental charging of the Lithium cells.

The core of the power supply design for the system is a 500 KHz switching regulator, IC41, which utilizes a flyback transformer configuration to generate the analog DC supply voltages. The primary of the transformer is designed to accept 6.0 to 13 V DC input and provides secondary outputs of nominally +13.5VDC, and -13.5VDC which are regulated by R11 and R13 off of the +VA supply. These supplies (±VA) feed all of the analog circuitry in the monitor. All supplies are L-C filtered to minimize noise in the analog front end. An additional switching regulator (IC26) generates the 5VDC supply (VDD) which feeds all the logic circuitry in addition to a filtered version (CVDD) which supplies the logic level requirements of the CO2 signal path (data converters, etc.). The 5V supply is L-C filtered to provide clean logic supplies for the analog sections of the CO_2 (CVDD) system. IC10 and IC12 are linear regulators which provide clean, well regulated supplies (±CVA) for the CAPNOSTAT. IC23 and IC42 are designed as a tracking regulator pair to provide a 24VDC differential voltage for powering the CAPNOSTAT source (+VSRC, -VSRC). Power for the CAPNOSTAT Heaters is supplied by VDCIN for maximum efficiency. Refer to Table 5 for power supply descriptions.

Table 5: Power Supply and Reference Outputs

Signal	Supply	
VDCIN	+6.0V to +13VDC	Main DC input generated from external DC input or internal battery.
VBATT	+6.0V to +10.2VDC	Internal Battery DC input, max level dependent on battery installed.
VBACKUP	+2.5VDC or +5VDC	Supply for SRAM and Real Time Clock, either VDD or 2.5V to maintain SRAM data during power down.
VHTR	VDCIN	Supply for the CAPNOSTAT Case and Detector heaters, supplied by battery or external DC input. When powered by battery heater power follows input power.
VDD	+5VDC	Regulated digital logic supply.
CVDD	+5VDC	Regulated and filtered logic supply for CO_2 analog front end.
+VA	+13.5VDC (nominal)	Tightly regulated +13.5V DC supply.
+CVA	+12VDC	Linearly Regulated and filtered positive supply for the CAPNOSTAT.
+VSRC	+12VDC	Linearly Regulated and filtered positive supply for the CAPNOSTAT Source. Tracks -VSRC to provide a 24V +/- 2.5% differential voltage across the source.
-VSRC	-12VDC	Linearly Regulated and filtered negative supply for the CAPNOSTAT Source. Tracked by +VSRC to provide a 24V +/- 2.5% differential voltage across the source.
-VA	-13.5VDC (nominal)	Loosely regulated off of the +13.5VDC feedback line.
- CVA	-12VDC	Linearly Regulated and filtered negative supply for the CAPNOSTAT.

Table 5: Power Supply and Reference Outputs		
Signal	**Supply**	
CVREF	+2.5VDC	Buffered reference for the A/D Converter.
2CVREF	+5.0VDC	Buffered reference used in the CAPNOSTAT heater control circuitry.
-2CVREF	-5.0VDC	Buffered reference used for the contrast control circuitry.
VREFO/2	+1.25VDC	Buffered reference used for DC excitation for the barometric pressure sensor.

See page 6 on schematic

Stable reference voltages for the sensors and analog circuitry are derived from IC28, a precision 2.5V reference generator with low drift. Five (2CVREF) and 2.5 (CVREF) Volt references for the CO_2 circuits are generated by IC30A and IC30B, while a separate 1.25 (VREFO/2) Volts is generated directly from IC32B.

When the monitor is operated from the DC input power source, the green AC ON indicator on the front panel is lit (refer to the 2737 schematics). If the monitor is on, pressing the Power key on the front membrane keypanel will not completely power the monitor down. Instead, the monitor is placed in a standby operating mode. The display, backlight and other non-essential control functions are inactivated by the software, giving the monitor the appearance of power down. While in standby however, the core system continues to operate, keeping the CAPNOSTAT heaters within temperature regulation. This reduces the time required to bring the system up to full operating specifications during the following power-up cycle.

If DC input power is lost or is not available, the monitor automatically operates from its internal battery without interruption. The AC ON indicator is extinguished and a Battery LED on the front panel lights up, indicating the current power level of the battery. While on internal DC power, the current state of the battery is monitored by both software and hardware (IC37B and IC43B, schematic page 7). Should the battery power level become critically low, the monitor software alerts the user. If the monitor is not placed on external DC input power within approximately ten minutes, the software will put the unit in standby. Should the user fail to turn the monitor off when the low battery alarm sounds, the hardware cutoff (IC43B) activates (+VBATT=6.0V), turning the unit off. While on battery operation, depressing the Power key on the front keypanel will turn the monitor off; stand-by mode is disabled and power to the system is turned off.

3.7.1 2737 Board

(refer to 2737 schematic sheet 1)

The internal NiMH battery will charge when the monitor is connected to the DC wall mount adapter or installed in the cradle option. Battery charging is controlled by IC1, a frequency modulated fast charge controller. IC1 monitors temperature, voltage, and time throughout the charging process to safely and effectively charge the internal battery. The charger is configured to terminate charging using the $\Delta T/\Delta t$ (delta temperature/delta time) method of charge termination. Charging is maintained at the C/4 (600mA) rate while current to the battery is controlled by Q1, Q2, Q3, and the MOD output of IC1. Q3 provides base drive for Q1 while Q2 serves to shut Q1 off very quickly on a cycle by cycle basis allowing the large currents required for charging to pass through Q1 which is a surface mount SOT-23 package capable of 500mW power dissipation. Temperature is monitored using the battery's internal thermistor, R16, R17, and R19. R16, 17 & 19 set the $\Delta T/\Delta t$ charge termination parameter to 1ºC per minute. R14 and R15 set the maximum temperature for charge termination (a safety override) to 45ºC. Battery charging is initiated in one of two ways. Either by applying 13 VDC to +VCHG, therefore providing VCC (BVDD) to IC1, or by inserting a rechargeable battery into the battery compartment (provided external power is available). BVDD (VCC for IC1 and D4, the AC ON indicator) is regulated by D10, a 5.1V zener diode while

R9 keeps D10 operating in the knee region and C5 and C7 provide filtering. Over current protection is provided by F1, a 1A slo-blo replaceable fuse. Reverse leakage protection is provided by D5 and D6 which prevents the battery from trying to power BVDD and +VCHG in the battery operation state.

Section 4 *Functional Tests*

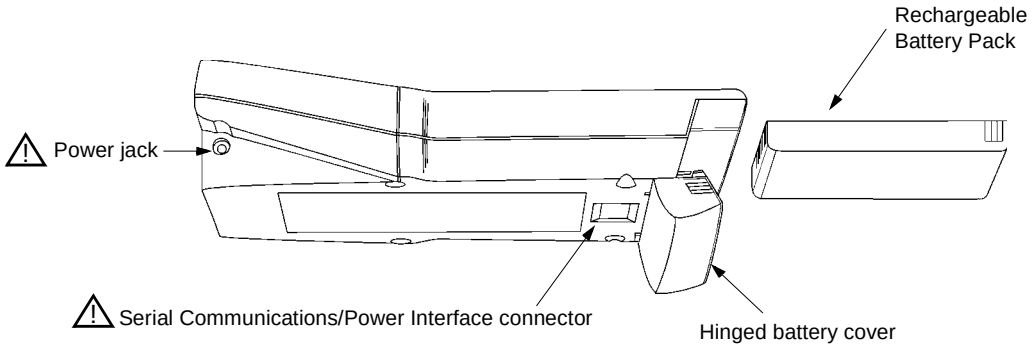
The Functional Test described below verifies overall functional integrity of the monitor and sensor. If the TIDAL WAVE monitor does not pass these tests, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

4.1 Equipment Required

1. Disposable Adult Airway Adapter PN: 6063-01
2. Disposable Neonatal Airway Adapter PN: 6312-01
3. NiMH rechargeable battery pack PN:400043 or equivalent,
   (batteries (7) “AA” 1.5V PN: 400050 and case PN: 6862-01, if supplied)
4. AC to DC adapter PN: 6879-10

4.2 Procedure

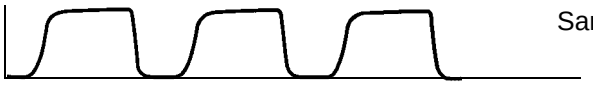
1. Visually inspect the monitor and verify that there is no external damage.
2. Open hinged cover and install the NiMH rechargeable battery pack
   PN: 400043 into the unit.



WARNING: Do NOT connect to any device not approved by Novametrix.

3. Plug the DC adapter PN: 6879-10 into an AC outlet, then plug the other end into the unit under test.
4. Verify the ∿ LED on the keypanel illuminates.
5. Power the unit up by pressing the Power key on the keypanel.

6. Verify the unit displays error ⚠2 then “CHECK ADAPTER” at the top of the display.
7. Connect the Disposable Adult Airway Adapter PN: 6063-01 to the CAPNOSTAT.
8. Breathe into the airway adapter and verify both the readings and the waveform displayed on the computer are acceptable.



Sample Waveform*

*(Waveform appearance will vary depending upon breath rate and display sweep speed.)

9. Press the Backlight ☼ key and verify that the back light turns off. Press the backlight ☼ key again and verify the back light turns on.
10. Press and hold the Backlight ☼ key and verify that the display contrast is adjustable from light to dark. Set the contrast of the display to a viewable level.
11. Press the Waveform key and verify a trend waveform is present.
12. Press the Waveform key again. Stop breathing into the adapter and verify an alert condition after approximately 20 seconds (alert LED flashing red and an audio alert).
13. Press the Alert key. Verify a 2 minute audio silence is initiated and the LED on this key is flashing red then yellow.
14. Change the airway adapter from the adult disposable to the neonatal disposable. Allow the airway adapter to warm up on the CAPNOSTAT for approximately two minutes.
15. Press the Neonatal (NEO) key and verify that “CHANGE ADAPTER TYPE TO NEONATAL - YES NO” is displayed.
16. Press the YES softkey and verify a drawing of an adult and an infant (flashing) is displayed. Verify the unit is in the Neonatal Mode as indicated by the NEO (NEO) LED being illuminated.
17. Remove the DC adapter from the unit and verify that the AC ON ∿ LED is off and the Battery LED is illuminated (green).
18. Power the unit down then power it back up again. Ensure the monitor functions properly on battery operation.
19. Power the unit down and remove the rechargeable battery pack from the unit.
    NOTE: Steps 3.36 to 3.38 do not apply if the monitor does not come with a “AA” battery pack.
20. Install (7) seven “AA” batteries into the battery case PN:6862-01 ensuring proper polarity.
21. Install the battery case into the unit, power up the unit and ensure it functions properly on battery power.
22. Turn the unit off by pressing the Power key. Remove the battery pack from the unit. Remove the “AA” batteries from the battery case.

Section 5 *Accuracy Tests*

The Accuracy Test verifies the performance accuracy of the Model 610. This test is typically performed in conjunction with (after) the Functional Tests described on page 19. If the monitor does not pass the accuracy test, remove from use and contact the Novametrix Service Department for repair/replacement assistance.

This procedure assumes the technician performs each step as indicated—leaving the monitor in a known state prior to performing the next step. If steps are omitted or performed out of order, be sure that the monitor is set to the correct state before continuing.

5.1 Equipment Required

- 400043 TIDAL WAVE rechargeable battery (fully charged)
- 6879-00 TIDAL WAVE AC wall adapter/charger
- 6063-01 Adult Disposable Airway Adapter (Qty 3)
- 8364-00 Low Point Calibration Gas
- 6080-00 Gas Regulator (for use with calibration gas above)
- Calibrated barometer (for checking monitor's automatic barometric pressure reading)
- Room thermometer
- Calculator

5.2 Test Procedure

1. Install the battery in the TIDAL WAVE.
2. Connect the AC wall adapter/charger jack to the TIDAL WAVE. Verify the ∿ LED illuminates.
3. Press the Power key then immediately press and hold the ☼ and 🔔 keys. The monitor should power up and display "Resetting to factory defaults".
   Note: A "Sensor Warming" message may appear on initial power up. This is a normal condition.
4. Press and hold the NEO (NEO) key immediately followed by the backlight / contrast ☼ key to enter the CONFIGURATION screen.
5. Verify the setting in the #1 position is GAS COMPENSATION: ROOM AIR.
6. Press the (NEO) (EXIT) softkey to return to the main screen.
7. Connect the CAPNOSTAT CO_2 sensor to the disposable airway adapter. Allow the airway adapter to warm up on the sensor for a minimum of two minutes.

8. Press and hold the NEO key until the monitor displays the "Zero/Verify" menu. Press the NEO key to enter the "Verify" menu. The instantaneous value should be .4 (+.5 -.4 torr). The value may take a few seconds to stabilize.

NOTE

While the zero calibration is in process there should be no CO_2 in the immediate area of the airway adapter.

9. Follow the instructions supplied with the Gas Regulator to connect the CAPNOSTAT CO_2 sensor.
10. Record the barometric pressure (in mmHg) and temperature (in °C) of the room.
11. Calculate the nominal CO2 readings using the following:

$$N = \frac{(CO_2\%) \cdot (Pbaro)}{1-0.003 \cdot (33-T)}$$

Where:
Pbaro=barometric pressure in mmHg
T=temperature in degrees centigrade
N=the nominal corrected CO_2 value for the given CO_2%
CO_2%=percentage of CO_2 test gas used, e.g. 5% CO_2 test gas = .05

Example:

If T=23 and Pbaro=760
then
$N=((CO_2\%) \cdot 760) / 1-0.003 \cdot 10)$
$N=CO_2\% \cdot 783.505$
N=39.2 (for CO_2%=.05 or 5% test gas)

For N<40; Low=N-2, High=N+2
For 40<N<70; Low=0.95 · N, High=1.05 · N
For N>70; Low=0.92 · N, High=1.08 · N

CO_2%=.05 N=39.2 Low=37.2 High=41.2

12. Flow gas for thirty seconds. Record the CO_2 reading. Verify the reading is between the Low and High limits for CO_2% gas calculated above.
13. Stop gas flow. Disconnect the gas regulator and additional adapters from the CAPNOSTAT CO_2 sensor (leave the one connected to the sensor).
14. Press the key to exit the "Zero/Verify" screen.
15. Press and hold the NEO key followed by pressing and holding the key. Press the key until the "CAPNOSTAT S/N" screen is displayed (should be three times). Press and hold the key to enter the "Parameter" screen.
16. Verify the following:

From Model 610 display		units (not displayed)
SRCI	180-300	mA

CTMP	45.00 ± 0.2	°C
DTMP	45.00 ± 0.2	°C
DCHN	3600 ± 200	A/D counts
RCHN	3600 ± 200	A/D counts

17. Press the key to exit, then press the key to power down the monitor.
18. This completes the Accuracy Tests for the Model 610.

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Section 6 *Electronic Tests*

The Electronic Tests verify the calibration and operation of the electronic circuits within the Model 610. These tests DO NOT need to be performed on a regular (preventative) basis. Perform these tests only if the monitor fails to operate as expected or fails the Accuracy Tests or the Functional Tests. The Electronic Tests should be performed only by qualified service personnel.

The Electronic Tests require access to the internal components of the monitor. Refer to page 33 for disassembly instructions.

CAUTION

The Model 610 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

6.1 Equipment Required

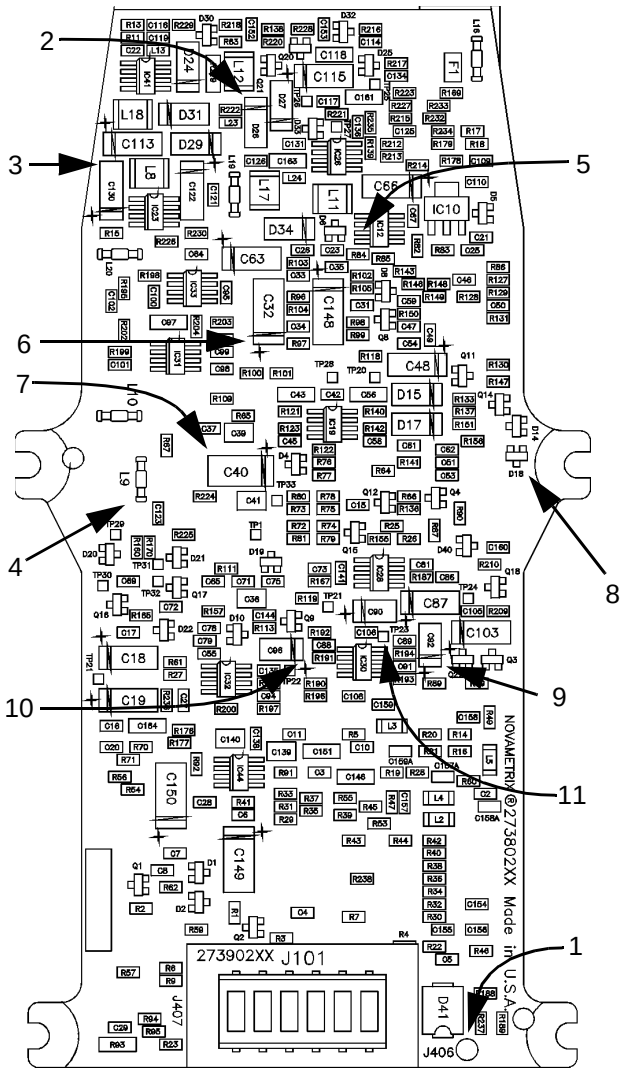
- AC to DC adapter PN: 6879-00
- DVM
- Oscilloscope
- Single Patient Use Airway Adapter (6063-adult, 6312-neonatal)

6.2 Test Procedure

1. Remove the battery (trends, date and time will be lost).
2. Disassemble unit to expose circuit boards.
3. Situate the boards so that no shorting can occur. Connect the AC to DC adapter.
4. Press the Power

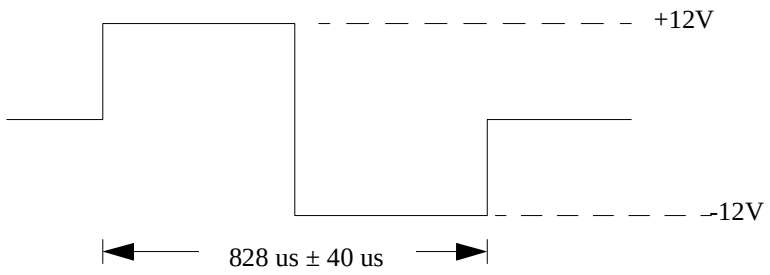
key to power up the main board. Verify the proper power up sequence is on the LCD display.
5. Verify “Sensor Warming” and a “1” are flashing on the display.
6. Connect the airway adapter to the CAPNOSTAT CO_2 sensor.

7. Measure the following voltages on the 2738 board. Use TP 12 as ground reference. Refer to the illustration for test point locations.

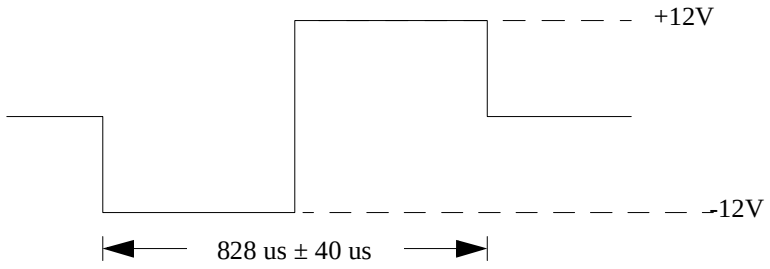


	Signal Name	Location	Voltage	Tolerance
1	VDD	TP 17 feed through	5.00 V	± 100 mV
2	+ VA	D26 cathode	+ 13.75 V	± 500 mV
3	- VA	C130 neg. lead	- 13.75 V	± 500 mV
4	+ CVA	L9 or IC 10 pin 2	+ 12.00 V	± 500 mV
5	- CVA	IC 12 pin 3	- 12.00 V	± 500 mV
6	+ VSRC	C32 pos lead	+ 12.00 V	± 500 mV
7	- VSRC	C40 neg lead	- 12.00 V	± 500 mV
8	VHTR	D18 cathode	+ 8.00 V	± 1.00 V
9	CVREF	C92 Positive	+ 2.50 V	± 25 mV
10	VREFO/2	C96 Positive	+ 1.25 V	± 25 mV
11	- 2CVREF	TP23	- 5.00 V	± 50 mV

8. Enter the configuration menu by pressing and holding the NEO (NEO) key immediately followed by the ☼ backlight / contrast key.
9. Press the ☼ backlight / contrast key four times to display the engineering screen.
10. Verify the CTMP and DTMP rise and stabilize to 45.00 °C ± 0.1 °C.
11. Verify PB equals the recorded barometric pressure ±2. If not adjust using VR1 until the reading equals the recorded barometric pressure.
12. Verify the SRCI reads between 180 and 300 mA.
13. Press the EXIT softkey.
14. Press and hold the NEO (NEO) key for five seconds. Verify the Zero calibration screen is displayed.
15. Press the ZERO softkey. Verify a Zero calibration is performed, the monitor will "countdown" from 20 seconds.
16. Monitor D8 with the Oscilloscope. Verify a positive pulse 405 ± 10 us wide.
17. Monitor D8 with an Oscilloscope. Verify a positive pulse 393 ± 10 us wide.
18. Monitor TP33 with an oscilloscope. Verify the following waveform:



19. Monitor TP1 with an oscilloscope. Verify the following waveform:



20. Power down the board by pressing the Power (POWER) key.

6.3 Safety Testing

21. Using a leakage test fixture, and with the external AC adapter/charger connected, measure the leakage current:
    - Normal
    - Normal reverse ground
    - Normal ungrounded
      Verify a leakage current <50 uA.

Section 7 Maintenance

7.1 General

This section presents recommended maintenance schedules for the Model 610 and information on general maintenance, such as battery and fuse replacement, disassembly and assembly instructions, and system software updates.

7.2 Maintenance Schedules

The electronic circuits within the Model 610 hand-held capnograph monitor do not require scheduled calibration or service. However, in order to maximize battery life, the monitor's internal battery should be tested monthly. Novametrix recommends the following maintenance schedules.*

- Cleaning and Sterilization:
  Perform as required. See see Cleaning and Sterilization on page 30.
- Battery and AC Operation:
  Contains information on use of disposable lithium and rechargeable batteries. See see Battery and AC Operation on page 30.
- Functional Tests:
  The test verifies overall functional integrity of the monitor and sensor. See see Functional Tests on page 19.
- Accuracy Tests:
  The test verifies the calibration accuracy of the monitor using specified test apparatus. See see Accuracy Tests on page 21.
- Electronic Tests:
  These tests contain information on testing the electronic circuits within the Model 610 and should only be performed if the monitor fails to pass the Functional Tests. Only qualified service personnel should attempt to perform the Electronic Tests. See see Electronic Tests on page 25.

*. At the customer's request, Novametrix will provide repair and calibration services under terms of a Service Contract. Contact the Novametrix Service Department for contract details.

7.3 Cleaning and Sterilization

Follow the cleaning and sterilization instructions listed below to clean and/or sterilize the monitor and its accessories.

CAUTION

The airway adapter is designed for single patient use. Sterilizing may affect system performance.

7.3.1 Monitor

- Turn the monitor off and unplug the AC wall adapter/charger from the AC line before cleaning.
- The monitor can be cleaned and disinfected with solutions such as a 70% isopropyl alcohol, 2% glutheralhyde, or 10% bleach solution. Then wipe down with a water-dampened clean cloth to rinse. Dry before use.
- Do not immerse the monitor.
- Do not attempt to sterilize the monitor.

7.3.2 CAPNOSTAT CO_2 Sensor

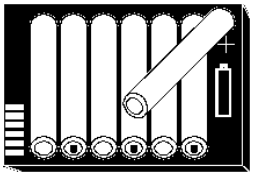
- Clean the sensor surface with a damp cloth.
- Make certain that the sensor windows are clean and dry.
- Do not immerse the CAPNOSTAT CO_2 sensor.
- Do not attempt to sterilize the CAPNOSTAT CO_2 sensor.

7.3.3 Single Patient Use Airway Adapters

- Treat all single patient use airway adapters in accordance with hospital protocol for single-patient use items.

7.4 Battery and AC Operation

The TIDAL WAVE can be powered from seven “AA” disposable lithium batteries, a rechargeable battery, or an AC wall adapter/charger available from Novametrix. With continuous operation a rechargeable battery will last approximately four and a half hours. Battery capacity is shown in the chart below. Times may be reduced in colder temperatures or with power cycling; operation with the backlight off may slightly increase these times. The optional AC wall adapter/charger will also charge a rechargeable battery in the monitor. Alternatively, the rechargeable battery can be charged in its external charger. Any batteries used with the 6862-00 case cannot be charged, it is for use with disposable type batteries only.

Power Source	Standard AA lithium batteries (7 ea. - disposable)	Optional Rechargeable battery, (NiMH 7.2 vdc)
		
Capacity, continuous	8 hours	12 hours
Recharge Time	n/a	4.5 hours
Catalog Number	400050 (battery) 6862-00 (case)	400043

7.4.1 Battery Indicator

While running on battery power, a battery life indicator will illuminate green for a charged battery, slowly flash yellow for a battery getting low, and quickly flash red when only a few minutes remain. The audio will sound during the flashing red condition, and for safety reasons, cannot be silenced.

NOTE

- The battery life indicator may not reflect the true battery status upon power-up during the first 30 seconds of operation. This is due to the power requirements of the monitor to heat the CAPNOSTAT CO_2 sensor to proper temperature.
- The battery life indicator is inactive when the monitor is powered by the AC wall adapter/charger.

7.4.2 Rechargeable Batteries

The NiMH rechargeable battery pack (Cat. No. 400043) can be used to power the TIDAL WAVE for approximately four and a half hours of continuous operation. To charge a rechargeable battery while in the monitor, plug the AC wall adapter/charger into the power jack on the side of the TIDAL WAVE (refer to AC wall adapter/charger - External DC supply section). The ∿ icon will illuminate and the battery will charge in approximately 5.5 hours. If the monitor has been stored with the battery installed for fourteen (14) days or more, recharge or replace it with a fully charged battery.

To charge the NiMH battery pack with the external charger:

- The external charger is for use with the rechargeable Duracell DR-30 battery only. In a non-patient area, connect the external charger to an AC source. Remove the battery from the TIDAL WAVE and insert it into the external charger. The battery will be fully charged in approximately 4.5 hours. Refer to the instructions supplied with the charger for additional information.

CAUTION

- The external battery charger should NOT be used to recharge the battery near or in close proximity to patients and/or other medical equipment in operation.

NOTE

- With a new battery, or a battery that has not been used for 30 days or more, charge the battery for 24 hours prior to use.
- New batteries, or batteries stored for extended periods of time, may need to be fully charged and discharged up to five (5) times before performing at full capacity.
- The monitor may not power up if the battery is not sufficiently charged.
- Dispose of batteries in accordance with local laws.
- Do not mix battery types or chemsitrys (e.g. disposable and rechargeable AA batteries, or Alkaline and Lithium).
- Refer to instruction sheet packaged with the rechargeable battery for complete operating instructions.

7.4.3 AA Lithium Batteries

To power TIDAL WAVE from AA lithium batteries, insert seven disposable batteries (Energizer L91 or equivalent see Accessories on page 45) into the optional Battery Case (Cat. No. 6862-00) following the polarity markings on the case.

WARNING

Batteries can explode, leak or catch on fire if heated or exposed to fire or high temperatures.

7.4.4 AC wall adapter/charger (External DC supply)

TIDAL WAVE can be powered from a Novametrix AC wall adapter/charger. DC voltage is supplied by the adapter/charger to the power jack located on the upper left side of the monitor.

To charge the battery using the AC wall adapter/charger:

Connect the AC wall adapter/charger to the TIDAL WAVE power jack, then connect the wall adapter/line cord to an AC source. The AC icon on the front key panel will illuminate. The TIDAL WAVE is now powered from the AC wall adapter/charger and the rechargeable battery, if installed, is being charged. Refer to chart on page 30 for battery charge times.

CAUTION

Although other connectors may physically fit, do not attempt to connect any device other than the Novametrix AC wall adapter/charger to the power jack on the TIDAL WAVE. Doing so may damage the TIDAL WAVE and will void the warranty.

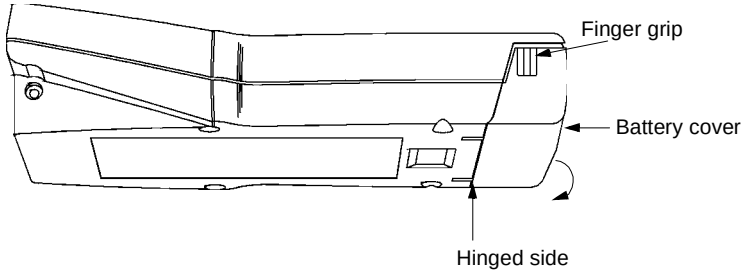
NOTE

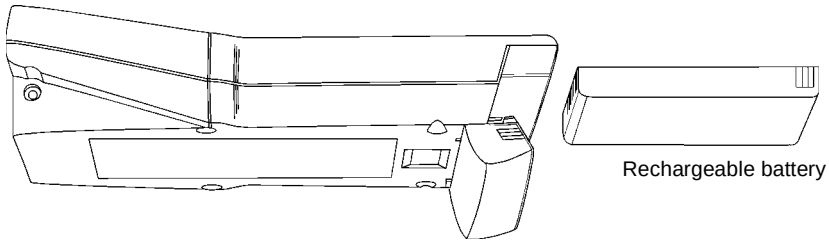
When powered by the AC wall adapter/charger, the TIDAL WAVE will not overcharge a rechargeable battery.

Both a 110 volt (Cat. No. 6879-10) and a 220 volt (Cat. No. 6880-10) version of the AC wall adapter/charger are available from Novametrix.

7.4.5 Removing and installing the battery

Grasp the finger grips on each end of the battery cover. Squeeze together and pull so that the cover opens to reveal the internal battery (the cover is hinged on the bottom of the case). Remove the rechargeable battery or the lithium battery case from the monitor.





The battery and battery case are keyed so that they can be installed in only one way (see illustration inside battery compartment on the serial number label). The contacts should go in first and be located toward the top left of the monitor when inserting (see illustration above). Make certain the battery cover is properly closed before operating the monitor.

7.5 Assembly Exchanges

The disassembly instructions below are intended as a guide to enable component exchanges if necessary. There are no user serviceable parts inside. Disassembly should be performed by qualified service personnel only.

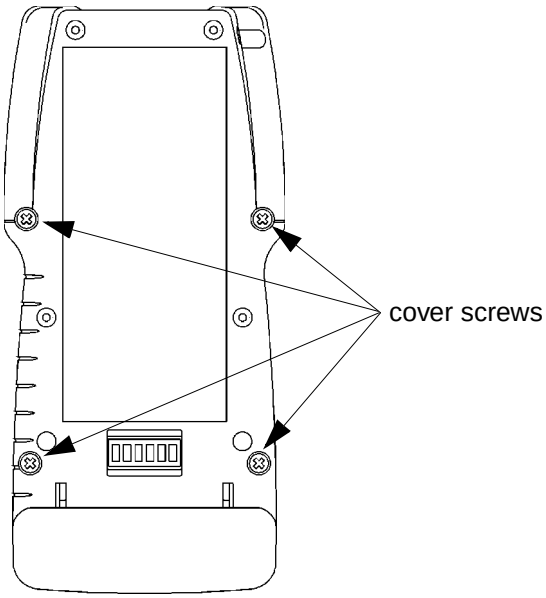
CAUTION

The Model 610 contains static sensitive devices. Be sure to follow proper grounding procedures when handling the internal components to avoid damage from static discharge.

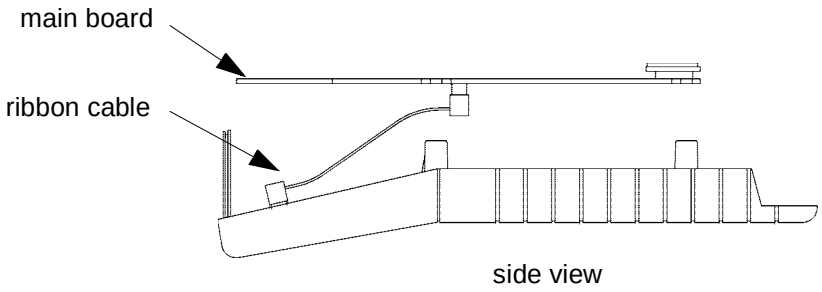
7.5.1 Disassembling the Monitor

1. Ensure that the monitor is OFF. Disconnect the A/C adapter, remove the battery pack.

2. Turn the monitor upside down and remove the four cover screws from the bottom cover.

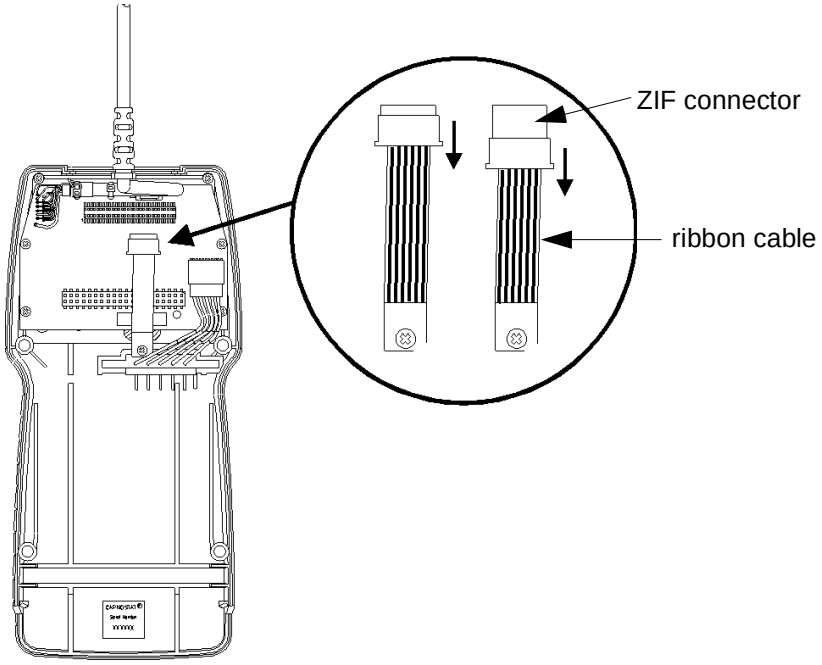


3. Carefully lift the rear cover from the monitor. The separate assemblies of the monitor can now be removed.
4. Lift the Main Board and disconnect ribbon cable from the Sensor Assembly Board by grasping the connector (not the cable) and gently rocking from side to side to loosen. Be carefule not to bend any pins when pulling the connector off of the header strips.

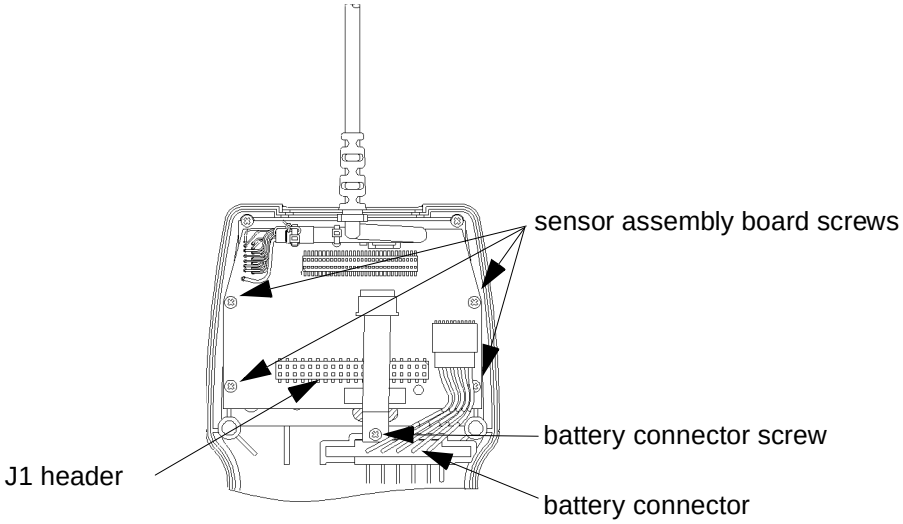


5. Remove the Main Board.
6. The Sensor Assembly Board, Display Board, and battery connector can now be accessed.

7. To disconnect ribbon cable J3, grasp the edge of the ZIF (zero insertion force) connector with one forefinger on either side. Pull gently *sideways* to release the mechanism. Slide the ribbon cable out.

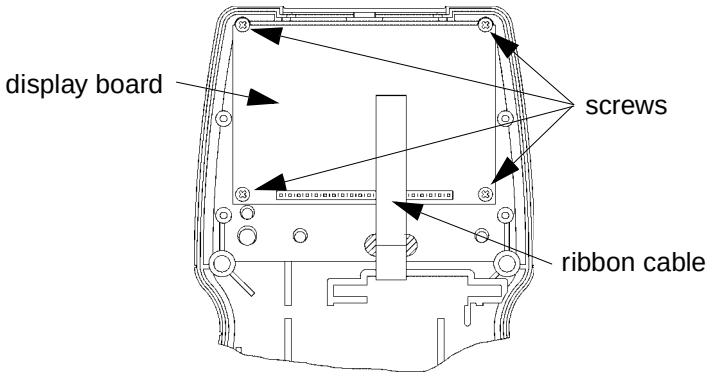


8. Remove four screws from the Sensor Assembly Board. Disconnect the screw on the battery connector (black and red wires).



9. Slide the battery connector out of the bracket and remove the sensor assembly board, rocking gently to release the header strip J1 which connects through the Sensor Assembly Board from the Display Board below.

10. Remove 4 screws holding the Display Board in place. Do not bend the tabs on the board, the LCD display can not be removed from the board. Be sure not to lose the plastic bezel located in between the LCD display and the display window.



7.5.2 Reassembling the monitor

1. Check the inside of the display window and the LCD display for dirt/finger prints, clean if necessary. Replace the plastic bezel around the display window. Set the Display Board in place and secure with 4 screws.
2. Place the battery connector (red and black wires) into the bracket and push in. Secure in place with 1 screw.
3. Place the Sensor Assembly Board in the case, taking care to align the pins at header strip J1 underneath—line the LEDs up with the openings in the case, this will give you a point of reference. When you are sure the pins are lined up with the holes, gently push down, do not force. Place the strain relief section on the sensor cable into the egress slot, push down to lock in.
4. Secure the Sensor Assembly Board with 4 screws.
5. Slide ribbon cable J3 into the ZIF locking connector, pushing gently to be sure that the cable is as far into the locking mechanism as possible. Push the connector closed to lock in the ribbon cable. Pull lightly on the ribbon cable to ensure that it is secure.
6. Replace ribbon cable from the Main Board to the Sensor Assembly Board and align the main board with the standoffs.
7. Ensure the battery gasket is set in place, refer to the assembly print 6700-01 (page 3) for placement. Place the back cover on the monitor. Secure with 4 screws.
8. Opened hinged cover and replace the rechargeable battery or battery pack. Battery is keyed to fit in only one direction. When the monitor is powered it will default to the factory default settings.

7.6 Serial Communications/Power Interface Connector

Located on the enclosure rear is a six pin modular contact which provides an RS232 interface as well as a power input for unit operation and battery charging when connected to Novametrix accessories. This connector meets the patient safety requirements of the following agencies: IEC 601-1, UL544, and TUV.

7.7 Software Update Instructions

The following procedure is for updating the monitor's software from a supplied TIDAL WAVE Software Update Kit using an IBM-compatible computer and the Base Station (Cat. No. 6998-00). Refer to any instructions that may accompany the software update diskettes for changes in the procedure or other pertinent information.

7.7.1 Equipment Required

- IBM compatible computer with an unused serial port (COM1 or COM2)
- TIDALWAVE Base Station (Cat. No. 6998-00)
- Serial Communication Cable (PN: 211923)
- Update diskette PN: 6893-57-XX and/or 6892-57-XX (XX = new firmware version)
- Reply card

7.7.2 Setup

Connect the serial cable to the Base Station. Connect the other end of the cable to the computer's COM[†] (serial) port. The update software allows use of either COM1 or COM2. When connecting the cable be sure to record which COM port is used, the program will prompt the user for this information before updating the software.

7.7.3 Procedure

Turn the TIDAL WAVE off, then place it into the base station. Remove the AC adapter/charger connector from the base station if installed. NOTE: All power to the TIDALWAVE must be removed otherwise the update will not operate properly.

Insert the update diskette into the computer's floppy drive (typically drive A).

From DOS: Type A: ↵ (where A is the drive letter where the update diskette is loaded). At the "A:" prompt type **UPDATE** then press ↵ .

From Windows 3.x: Boot to DOS and follow the DOS instruction above.

From Windows 95: Select Start, Run, then type A:update ↵ (where A is the drive letter where the update diskette is loaded)

Follow the install program screen instructions. Verify that the firmware version shown on the computer screen is correct, then press any key to continue.

When the following prompt appears:

```
Select the PC's COM port the instrument is connected to
from the following choices:
     1-COM1
     2-COM2
     any other key - exit
```

Press the 1 key if the serial communications cable is connected to COM 1.
Press the 2 key if the serial communications cable is connected to COM2.

[†]. The location and availability of the COM ports (COM1, COM2) will vary from computer to computer. Refer to the computer's documentation for more information. The update software can only communicate with the TIDALWAVE through either COM1 or COM2.

If you are not sure of the process, press any other key and call service or Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.

Turn the TIDALWAVE on (connect the AC adapter/charger to the base station if the battery is not fully charged). It is important that the TIDALWAVE is powered off when the update program is started, and is turned on after the program starts to access the monitor.

When the download starts the TIDALWAVE screen will blank and the following message will appear on the computer screen.

```
Validating File
```

then,

```
UPDATING FIRMWARE, DO NOT INTERRUPT. PERCENT DONE: xx%
```

The “xx” will count up from 0% through 100% as the update is completed.

The procedure is complete when the computer displays:

```
***PROGRAM COMPLETE***

F1-exit          Esc-back
```

Press F1 to exit the update program.

Check that the TIDALWAVE restarts and returns to normal operation, if not then perform the update procedure again or call Novametrix Service Department at 1-800-243-3444, in Connecticut call collect (203) 265-7701.

Record the serial number from the TIDALWAVE on the reply card. Fill in the remaining information and return the postage paid card to Novametrix.

Section 8 Display Status Messages

System Messages

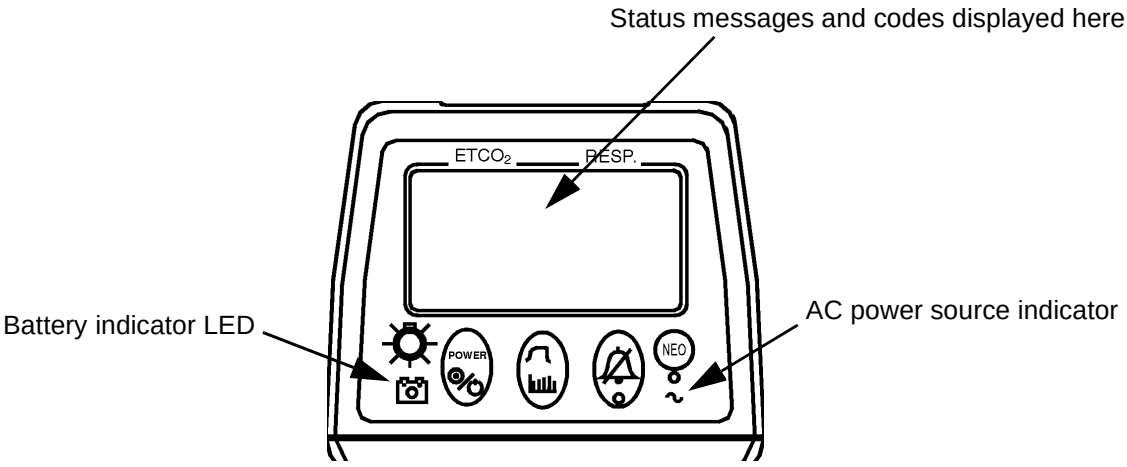
Shown below is a list of system messages that the Model 610 may display during normal operation. See “Status Messages and Codes” on page 41 and “Battery Status and Alerts” on page 41 for other messages.

Message	Meaning of message
ZRO: HOLD NEO KEY	Press and hold the NEO (NEO) key for five seconds to enter the zero menu.
ZERO CANCEL	Exits the zero function
30 min Trend	Appears when the Trend screen is selected and displayed
Novametrix Medical Systems Inc. Model 610 Checking System	Startup message. This message is displayed each time the Model 610 is powered on.
Resetting Monitor to Factory Defaults	The Model 610 will reset to factory defaults whenever the battery is removed for more than 1 minute, while the wall adapter/charger is not connected.
CO2 x.x Pb xxxx DCHN xxxx CBAT xxx RCHN xxxx DAGC xxx SRCI xxx.x RAGC xxx CTMP xx.xx CO2A x.x DTMP xx.xx CS xx CPWM xx VBAT x.xx DPWM xx EXIT	From the Configuration screen, press the backlight (☼) key to enter the engineering menu. The “x” will be actual values measured by the monitor.
RIGHT →, DOWN ↓, NEO: EXIT →	Press these softkeys to move around the configuration menu.
GAS COMPENSATION: ROOM AIR O2>60% N2O>60%	Configuration menu parameter and options.
WAVEFORM SCALE: SMALL MEDIUM LARGE	Configuration menu parameter and options. Refers to vertical scale on the capnograph waveform.

Message	Meaning of message
WAVEFORM SPEED: SLOW MEDIUM FAST	Configuration menu parameter and options. Refers to the sweep speed on the capnograph waveform.
NO RESP TIMEOUT: 20 sec. 40 sec. 60 sec.	Configuration menu parameter and options. A NO RESPIRATION alert will sound after 20, 40 or 60 seconds (depending upon setting chosen) if no breaths are detected.
ET UNITS: mmHg kPa %	Configuration menu parameter and options for $EtCO_2$ untis displayed.
ALERT VOLUME: DISABLED LOW HIGH	Configuration menu parameter and options for audible alert levels.
RS232 INTERFACE: NOVACOMM RESERVED	Configuration menu parameter and options for RS232 communications protocol.
WAVEFORM FILL: UNFILLED FILLED	Configuration menu parameter and options. Refers to the capnograph waveform.
CHANGE ADAPTER TYPE TO ADULT TO NEONATAL YES NO	Chose type by pressing the appropriate softkey below the message.
ADULT NEONATAL ADAPTER MODE	Mode must match adapter type.
CHECK CLOCK TIME AND DATE	Time and date may not be properly set. The time and date can be adjusted in the CONFIGURATION screen (press and *hold* the NEO key, then press the ☼ key). This message will appear whenever the battery has been removed for more than 1 minute and no other power is supplied to the unit (wall adapter/charger not connected).
ERASING STORED TRENDS	Perform this function from the Configuration menu; press the key a second time. The message “Erasing Stored Trends” will appear on the display. Trend information cannot be recovered once erased.
WARNING CHANGING CO2 UNITS ERASES STORED TRENDS	This is displayed when the “ET UNITS” are changed from the configuration menu. Trend information cannot be recovered once erased.

Battery Status and Alerts

The LED on the front panel flashes when the battery is extremely low; this will be accompanied by an audible alert. When this occurs connect the AC adapter to the monitor, and connect to an AC power source. Verify that the front panel icon illuminates green.



Message	**Meaning of message**
BATTERY TOO LOW REPLACE BATTERY OR PLUG IN AC CHARGER	A BATTERY EXHAUSTED alert will sound during continuous operation when the internal battery is depleted. The battery should be replaced or the AC adapter/charger should be connected to recharge the battery (rechargeable batteries only) and power the monitor. This alert can only be silenced by connecting the external supply or turning the monitor off.
WARNING HEATER POWER REDUCED TO CONSERVE BATTERY	When running on battery power and the battery power is low, this message will appear. The monitor will reduce the CAPNOSTAT CO_2 sensor heater power during initial warmup in an attempt to prolong monitor usage. This may increase start up time.

Status Messages and Codes

Status messages indicate conditions that should be corrected or monitored; they may or may not be tied to an alert condition. Following is a list of status messages that may appear on the monitor.

The TIDAL WAVE hand held capnograph displays a status triangle with a number and a message if certain conditions occur. The status triangle and message will display alternately between the $ETCO_2$ and RESP values. These conditions can be a result of a hardware or sensor fault condition. The code inside the triangle corresponds to the message listed below.

Message	**Trian-gle**	**Description**
SENSOR WARMING	1	Sensor is warming up. This message is displayed for two minutes, usually when the monitor is first powered on or if a new adapter is connected to the CAPNOSTAT CO_2 sensor.

Message	Trian-gle	Description
CHECK ADAPTER	2	Check adapter or select correct adapter type (adult/neonatal). To change adapter, wrong adapter (not single patient use), contaminated or obstructed airway adapter window, or obstructed airway adapter.
ZRO: HOLD NEO KEY	3	Measured CO_2 is negative.
SENSOR FAULTY	4	Faulty sensor. Call qualified service personnel.
PRESSURE FAULTY	5	Barometric pressure error. Call qualified service personnel.
OVER TEMP	6	Sensor over temperature. Call qualified service personnel.
CAN NOT ZERO	7	Zero error. Call qualified service personnel.
CO2 OUT OF RANGE	8	Measured CO_2 is greater than 99mmHg.
UNKNOWN ERROR	9	Refer to service manual. Call qualified service personnel.

Section 9 Specifications

9.1 Monitor Specifications

Below are specifications for the Novametrix TIDAL WAVE hand-held capnograph. These specifications are listed for informational purposes only, and are subject to change without notice.

9.1.1 Physical

- Size: 7.9” x 3.25” x 1.5”, Weight: 24 ounces.
- Operating Conditions: 32°F (0°C) -104°F (40°C), Humidity: 0-90% relative humidity, non-condensing.
- Transport/Storage -10°C to +55°C (14°F-131°F), 10-95% relative humidity non-condensing (without NiMH battery). Short term: -10°C to 50°C (with NiMH). Long term -10°C to 35°C (with NIMH).
- Battery: Rechargeable Nickel Metal Hydride DR30 or equivalent, or seven standard AA disposable High Energy Lithium batteries.
- Battery Life: >4.5 hours (time is for continuous use with fully charged battery).
- Display: LED Backlit 2.5” x 1.25” LCD, adjustable contrast.
- LED indicators for: Low battery, adapter type (illuminates for neonatal), audio/alert status (indicates audio off, 2 minute silence, active alert) and external power.
- AC wall adapter/charger: 120 VAC, 60 Hz or 22 VAC, 50 Hz.
- Per requirements of IEC 601-1, TIDAL WAVE is classified as class II equipment, internally powered, with type BF applied part and an enclosure protection rating of IPX1

9.1.2 Monitor and CAPNOSTAT CO_2 Sensor

- Principle of Operation: Non-Dispersive Infrared (NDIR) absorption, dual wavelength ratiometric-single beam optics
- Initialization time: Capnogram within 5 seconds, sixty seconds to full specifications.
- Response Time: Less than 75 ms.
- O_2/N_2O Compensation: Operator selectable in configuration screen.
- Barometric Pressure Compensation: Automatic.
- End Tidal CO_2:
  Range: 0-100 mmHg, 0-12.5 Kpa or %.
  Accuracy[1]: ± 2 mmHg for 0-40 mmHg, ± 5% of reading for 41-70 mmHg, ± 8% of reading for 71-100 mmHg.
  Resolution: 1 mmHg, 0.1% or kPa.
- Respiratory Rate - Range: 0-150 br/min, Accuracy: ± 1 br/min, Resolution: 1 br/min.

1. Allows for halogenated anesthetic agents which may be present at normal clinical levels. The presence of desfluane in the exhaled breath beyond normal values (5-6%) may positively bias Carbon Dioxide values by up to an additional 2-3 mmHg.

9.1.3 Symbol Descriptions

The following International Electrotechnical Commission (IEC) symbols appear on the TIDAL WAVE and its accessories:

Patient Isolation - identifies patient isolation type as BF.

Attention - Consult manual for detailed information.

Recycle or dispose of batteries in accordance with local law.

Section 10 *Accessories*

TIDAL WAVE (**Model 610**) *Capnography Monitor*

The table below is a list of accessories for the TIDAL WAVE Hand-Held Capnograph, Model 610 (Cat. No. 6700-00).

Catalog No.	Description
6063-00	Pediatric/Adult Single Patient Use airway adapters (box of 10)
6421-00	Pediatric/Adult Single Patient Use airway adapters with mouthpiece (box of 10)
6421-25	Pediatric/Adult Single Patient Use airway adapters with mouthpiece (box of 25)
6312-00	Neonatal Single Patient Use airway adapters (box of 10)
6312-25	Neonatal Single Patient Use airway adapters (box of 25)
400049	120/220V external charger
140084	Pole/shelf mount kit
400043	Rechargeable battery
6862-00	AA lithium battery case (requires 7 batteries)
400050	AA lithium battery
315127	Carrying Case
9220-10	AC Adapter/charger
6081-00	Gas regulator (for use with precision gas mixtures; see below)
8364-10	Precision gas mixture. Low point calibration gas.
8365-10	Precision gas mixture. High point calibration gas.
6700-23	TIDAL WAVE User's Manual

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Section 11 *Parts*

6700-00 TIDAL WAVE Hand-Held Capnograph, Model 610

Line No.	Part No.	QPA	Description
0001	2738-01	1	MAIN BOARD ASSY, MODEL 610
0002	6680-13	1	BOTTOM COVER W HOLE AND SHIELDING, HAND HELD
0003	6685-16	1	BATTERY DOOR, HAND HELD ENCLOSURE
0004	6768-27	1	MEMBRANE KEYPANEL, MODEL 610
0005	6773-10	1	SHIELD, MYLAR, BOTTOM COVER, MODEL 610
0006	6808-17	1	TRANSDUCER ASSY, CAPNOSTAT III, MODEL 610
0007	6823-10	1	FILLER, KEYPANEL, MODEL 610
0008	6838-10	1	GASKET, BATTERY DOOR, MODEL 610
0009	6839-10	1	GASKET, BATTERY
0010	6854-13	1	TOP COVER WITH SHIELDING, MODEL 610
0012	160044	0	ALCOHOL, ISOPROPYL, TECHNICAL GRADE
0013	161082	0	TAPE, UHMW POLYETHYLENE, .002 THK
0014	161102	0	ADHESIVE, RTV162, SILICONE, WHITE
0015	281211	0	SCREW, 2-56 X 1/4L, SELF TAPPING, BINDING HEAD
0016	286223	0	SCREW, 6-32 X 3/8 IN. L, PAN HD, PHILLIPS
0017	482605	1	LCD DISPLAY, W/ LED BACKLIGHT & CONN W GOLD PL
0018	600067	1	RIBBON CABLE, 60 PIN, RCPT-RCPT, 2.9"L, .05 X
0019	600518	1	BATTERY INTERCONNECTION CABLE, 5 PIN, 2.3 IN.

2738-01 Main Board Assembly

Part No.	Rev.	QPA	Description
2738-03	03	0	SCHEMATIC, MAIN BOARD, MODEL 610
2738-17	03	1	MAIN BOARD SUBASSY, MODEL 610
6837-10	01	1	GASKET, CONNECTOR CRADLE, MODEL 610
6949-07	01	1	PROGRAM, FLASH PEROM ASSY W BOOT CODE & SYS

2738-17 Main Board Subassembly

Part No.	QPA	Description
130015	1	TRANSDUCER, AUDIO, 2400 HZ, 12V, 40MA, .5 DIA
152085	1	CAPACITOR, 1500UF, 16V, AL ELCTLT, RADIAL, .3
152096	8	CAPACITOR, 220UF, 35V, 20%, ELCTLT, 8X10.8 CA
154072	17	CAPACITOR, .1UF, 50V, 10%, X7R, CER CHIP, S M
154079	6	CAPACITOR, 10UF, 25V, 10%, TANTALUM, SURFACE MOUNT
154086	3	CAPACITOR, 4.7UF, 10VDC, 20%, TANTALUM, SURFACE MOUNT
154093	7	CAPACITOR, 68UF, 16VDC, 10%, TANTALUM, SURFACE MOUNT
154103	1	CAPACITOR, .001UF, 50VDC, 10%, X7R, SURFACE MOUNT
154104	29	CAPACITOR, .01UF, 50VDC, 10%, X7R, SURFACE MOUNT
154105	2	CAPACITOR, 47PF, 50VDC, 5%, NPO, SURFACE MOUNT
154106	2	CAPACITOR, 22PF, 50VDC, 5%, NPO, SURFACE MOUNT
154108	6	CAPACITOR, 100PF, 50VDC, 5%, MLTILYR CER, SURFACE MOUNT
154111	7	CAPACITOR, .1UF, 16VDC, 5%, 1210 CASE, SURFACE MOUNT
154112	68	CAPACITOR, .047UF, 16VDC, 10%, X7R, SURFACE MOUNT
154113	1	CAPACITOR, 4700PF, 50VDC, 10%, X7R, SURFACE MOUNT
154116	6	CAPACITOR, 10UF, 35V, 10%, LOW ESR, SURFACE MOUNT
180022	6	INDUCTOR, 10UH, 10%, SURFACE MOUNT
180029	4	INDUCTOR, 50MHZ CUT-OFF FREQUENCY, SURFACE MOUNT
180030	7	INDUCTOR-CAP, 4700PF, 50VDC, 2A, 3 TERM, SURFACE MOUNT
180034	1	FERRITE FILTER, 4 LIN, EMI SUPPRESSION, SURF ACE MOUNT
180043	4	FERRITE BEAD, 30 OHMS AT 100MHZ, 0603 STYLE
180045	2	INDUCTOR, 220UH, 20%, .53 OHMS 15% DCR, SURF ACE MOUNT
210141	1	CONNECTOR, DC PWR JACK, SOLDER TERM, PC/PNL M
211407	1	CONNECTOR, 4 PIN, HEADER, .100 SPACING, PC MOUNT
212108	1	CONNECTOR, 10 PIN, HEADER, DUAL ROW, .1 SP
213900	1	CONNECTOR, 60 PIN, HEADER, .05 X .1 SP, SURF ACE MOUNT
215073	1	SOCKET, PLCC, 32 PIN, .05 SP, LOW PROFILE
216029	0	TEST POINT, SPRING LOADED, 475 DEG C MAXIMUM
230024	1	CRYSTAL, 32.768 KHZ, SURFACE MOUNT
2738-02 rev00	1	FAB, MAIN BOARD, MODEL 610
2739-01 rev00	1	BATTERY & COMM INTERFACE BOARD ASSY, MODEL 610
474194	2	RESISTOR, 2.2M OHM, 1/16W, 5%, SURFACE MOUNT
474197	12	RESISTOR, 49.9K OHM, 1/16W, 1%, SURFACE MOUNT
474198	4	RESISTOR, 2.49K OHM, 1/16W, 1%, SURFACE MOUNT
474222	4	RESISTOR, 10 OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474224	23	RESISTOR, 100 OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT

Part No.	QPA	Description
474225	9	RESISTOR, 499 OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474227	10	RESISTOR, 1K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474229	5	RESISTOR, 2.05K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474230	2	RESISTOR, 3.32K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474231	6	RESISTOR, 4.99K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474233	75	RESISTOR, 10K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474234	2	RESISTOR, 20.5K OHM, 1/16W, 0603 STYLE, SURFACE MOUNT
474235	4	RESISTOR, 24.9K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474236	4	RESISTOR, 33.2K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474238	1	RESISTOR, 37.4K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474239	3	RESISTOR, 75K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474240	24	RESISTOR, 100K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474241	6	RESISTOR, 150K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474242	1	RESISTOR, 249K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474243	2	RESISTOR, 324K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474245	6	RESISTOR, 1M OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474247	1	RESISTOR, 10M OHM, 1/16W, 5%, 0603 STYLE, SURFACE MOUNT
474250	1	RESISTOR, 43.2K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474251	3	RESISTOR, 61.9K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474253	1	RESISTOR, 4.32K, 1/16/W, 1%, 0603 STYLE, SURFACE MOUNT
474256	7	RESISTOR, 0 OHM, 0603 STYLE, SURFACE MOUNT
474257	1	RESISTOR, 1 OHM, .5 W, 1%, 2010 SIZE, SURFACE MOUNT
474259	3	RESISTOR, 15K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474261	2	RESISTOR, 7.5K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
474266	1	RESISTOR, 4.75K OHM, 1/8W, 1%, 1206 SIZE, S M
474267	1	RESISTOR, 6.19K OHM, 1/16W, 1%, 0603 SIZE, SURFACE MOUNT
474269	2	RESISTOR, 121K OHM, 1/16W, 1%, 0603 SIZE, SURFACE MOUNT
474270	6	RESISTOR, 200K OHM, 1/16W, 1%, 0603 SIZE, SURFACE MOUNT
474283	1	RESISTOR, 392K OHM, 1/16W, 1%, 0603 STYLE, SURFACE MOUNT
475052	1	POTENTIOMETER, 1K OHM, 10%, TOP ADJ, M-TURN
481546	8	DIODE, MMBD914L, SWITCHING, SURFACE MOUNT
481547	4	DIODE, BAT54, HOT CARRIER SCHOTTKY, SURFACE MOUNT
481548	4	DIODE, EGL41B, RECTIFIER, SILICON, SURFACE MOUNT
481549	6	DIODE, MBRS140T3, RECTIFIER, SURFACE MOUNT
481552	3	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A, SSURFACE MOUNT
481554	4	DIODE, BAV70LT1, DUAL COMMON CATHODE, 70V
481555	11	DIODE, MMBD7000LT1, DUAL SWITCHING, SURFACE MOUNT
482551	1	LED, RED, WITH LENS, SURFACE MOUNT

Part No.	QPA	Description
483019	1	TRANSISTOR, MMBT2907ALT1, PNP, SOT-23, SURFACE MOUNT
484060	1	TRANSISTOR, MMBT3904T, NPN, SURFACE MOUNT
484562	2	IC, LT1175CS8-ADJ, MICROPOWER REGULATOR, 8 P
484563	2	IC, LT1117CST, VOLTAGE RGLTR, POS, ADJ, 3 P
484567	1	VOLTAGE REGULATOR, LT1372CS8, 35V, 8 PIN, SURFACE MOUNT
484569	1	VOLTAGE REGULATOR, LT1375CS8-5, 8 PIN, SURFACE MOUNT
485532	15	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE, SURFACE MOUNT
485541	3	TRANSISTOR, SI9947DY, MOSFET, DUAL P-CH ENH
485543	2	TRANSISTOR, SI9952DY, MOSFET, N-CH & P-CH, -2
486038	1	IC, MC68332FC, MICROPROCESSOR, 132 PIN SURFACE MOUNT
486042	1	IC, AT93C66-10SC, SERIAL 4K EEPROM, 8 PIN, SR
486050	1	IC, AS7C512-20JC, 64K X 8 RAM, 20NS ACCESS, 3
486323	1	IC, SN74HC573DW, OCTAL D-TYPE LATCH W 3-ST OU
486325	1	IC, MC14093BD, QUAD 2-IN SCHMITT TRIGGER, SURFACE MOUNT
486326	1	IC, MC14013BD, DUAL D FLIP-FLOP, SURFACE MOUNT
486340	1	IC, TLC2543CDW, 12 BIT A TO D CONV, 20 PIN
486346	3	IC, TC7SOOFTE85L, 2-IN NAND GATE, CMOS, 5 PIN
486354	1	IC, LTC1384CS, L PWR RS232 RECEIVER, 18 PIN
486790	7	IC, TLE2022CD, DUAL OP AMPLIFIER, H SPEED, LO
486796	3	IC, TLC2272CD, DUAL OP AMP, RAIL TO RAIL, 8 PIN
486805	3	IC, LM393M, DUAL VOLTAGE COMP, L PWR, SURFACE
486807	1	IC, SMP04ES, QUAD SAMPLE & HOLD AMP, 16 PIN
486808	1	IC, AD680JR, 2.5 VOLTAGE REF, L PWR, 8 PIN
486811	1	IC, TLC2262AIDR, DUAL OP AMP, RAIL TO RAIL
486819	1	IC, AD7564BR, 12-BIT D TO A CONV, QUAD, L PWR
487085	1	IC, MAX872CSA, 2.5V PREC VOLTAGE REF, SURFACE MOUNT
487094	1	IC, RTC-62423, REAL TIME CLOCK W QTZ CRYSTAL
487100	1	IC, TC1426COA, INV DUAL MOSFET DRVR, 1.2A
487102	1	IC, 1220A-015A-3N, PRESSURE SENSOR, 8 PIN
487103	1	IC, TC4405COA, DUAL OD FET DRVR, NON-INV, 1.5
487104	1	IC, TC4404COA, DUAL OD FET DRVR, INV, 1.5A
487108	1	IC, TL7757CD, VOLTAGE SUPERVISOR, 8 PIN, S MN
487115	1	IC, AD620BR, INSTR AMPLIFIER, L PWR, 8 PIN
513010	1	1 SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SP, SURFACE MOUNT
515092	1	FUSE, 3A, 32V, VERT FAST-ACTING, 1206 STYLE
560009	1	TRANSFORMER, 10UH 20% @ .1VRMS, 100K HZ, SURFACE MOUNT
Line 0001 486821	0	IC, AD822AR, FET-IN OP AMP, L POWER, 8 PIN

Part No.	QPA	Description
Line 0001 486823	2	IC, LT1490CS8, RAIL TO RAIL OP AMP, 8 PIN

6808-17 Transducer Assembly, CAPNOSTAT III

Line No.	Part No.	Rev	QPA	Description
0001	2737-01	00	0	INTERFACE BOARD ASSY, MODEL 610
0002	6808-09	00	1	OVERALL WIRING DIAGRAM, TRANSDUCER
0003	6809-17	00	1	CABLE PREPARATION, MODEL 610
0004	7125-32	01	1	CABLE PREPARATION, MODEL 610
0005	7143-16	02	1	RETAINING CAP, KEVLAR STRAND
0006	7168-01	05	1	INTEGRATED SUBASSY (ISA)
0007	7187-26	00	1	TRANSDUCER HOUSING W/ ARROW, UPPER
0008	7188-13	00	1	TRANSDUCER HOUSING SHIELDING, LOWER
0009	6808-04	00	0	TEST PROCEDURE, CAPNOSTAT III, MODEL 610
0010	6808-43	00	0	DATA SHEET, TRANSDUCER ASSY, CAPNOSTAT III
0014	161060		0	EPOXY, 2 PART (5/7), GRAY
0015	161098		0	TAPE, KAPTON, 3/8 W X .002 T, ACRYLIC, PRESS
0016	280210		1	O-RING, .239 ID X .025 WIDE, NITRILE
0017	280211 or 280226		1/0	O-RING, .472 ID X .024 WIDE, NITRILE or O-RING, .472 ID X .024 WIDE, SILICONE
0018	280232		2	SPRING CONTACT, SELF-ADHV BACK, BERYLLIUM COP
0019	320039		0	SOLDER, 63% TIN-37% LEAD, P2 FLUX, .032 DIA
0020	608001		0	CABLE TIE, .094 X 3.62L, SELF-LKG, 1/16 TO 5/8
0021	608007		0	TUBING, HEAT SHRINK, 1/4 (6.4) DIA, BLACK
0022	608005		0	TUBING, HEAT SHRINK, 1/16 (1.6) DIA, BLACK
0023	315097		1	BAG, STATIC SHIELDING, ZIPPER, METAL OUT
0024	315098		1	LABEL, ESD, REUSABLE, WITH RS-471 SYMBOL, 5/8

2737-01 Interface Board Assembly

Part No.	QPA	Description
154072	8	CAPACITOR, .1UF, 50V, 10%, X7R, CER CHIP, S M
154078	1	CAPACITOR, 1000PF, 50VDC, 10%, NPO, MONO CERA
154079	2	CAPACITOR, 10UF, 25V, 10%, TANTALUM, SURFACE MOUNT
154093	2	CAPACITOR, 68UF, 16VDC, 10%, TANTALUM, SURFACE MOUNT

Part No.	QPA	Description
180022	1	INDUCTOR, 10UH, 10%, SURFACE MOUNT
180030	5	INDUCTOR-CAP, 4700PF, 50VDC, 2A, 3 TERM, SURFACE MOUNT
180034	1	FERRITE FILTER, 4 LIN, EMI SUPPRESSION
180035	2	FERRITE FILTER, 8 LINE, EMI SUPPRESSION
180046	1	INDUCTOR, 18UH @ 2.5M HZ, +25% -15%, SURFACE MOUNT
211514	1	CONNECTOR, 5 PIN, HEADER, RT ANGLE, .1 SP
211639	1	CONNECTOR, 6 PIN, RCPT, ZIF, R ANG, .05 SP
213411	1	CONNECTOR, 40 PIN, RCPT, PASS THRU, DIL, STR
213900	1	CONNECTOR, 60 PIN, HEADER, .05 X .1 SP, SURF
216029	0	TEST POINT, SPRING LOADED, 475 DEG C MAXIMUM
2737-02	1	FAB, INTERFACE BOARD, MODEL 610
2737-03	0	SCHEMATIC, INTERFACE BOARD, MODEL 610
280233	1	SPACER, LED, FOR 2 LEADS, .2 DIA X .1 LONG
280234	2	SPACER, LED, FOR 3 LEADS, .255 DIA X .185 L
280235	1	SPACER, LED, FOR 2 LEADS, .25 DIA X .2 LONG
474136	3	RESISTOR, 1K OHM, 1/8W, 1%, SURFACE MOUNT
474161	1	RESISTOR, 5.9K OHM, 1/8W, 1%, SURFACE MOUNT
474170	2	RESISTOR, 301K OHM, 1/8W, 1%, SURFACE MOUNT
474174	6	RESISTOR, 332 OHM, 1/8W, 1%, SURFACE MOUNT
474182	1	RESISTOR, 150K OHM, 1/8W, 1%, SURFACE MOUNT
474220	2	RESISTOR, ZERO OHM, 1/4W, 5%, 1206 STYLE, SURFACE MOUNT
474263	1	RESISTOR, 28K OHM, 1/8W, 1%, 1206 SIZE, SURFACE MOUNT
474277	1	RESISTOR, .15 OHM, 1/2W, 2010 STYLE, SURFACE
474278	1	RESISTOR, 237K OHM, 1/8W, 1%, 1206 STYLE, SUR
474279	1	RESISTOR, 562 OHM, 1/8W, 1%, 1206 STYLE, SURF
474280	1	RESISTOR, 243 OHMS, 1/8W, 1%, 1206 STYLE, SUR
474281	1	RESISTOR, 71.5K OHM, 1/8W, 1%, 1206 STYLE, SR
474282	1	RESISTOR, 4.64K OHM, 1/8W, 1%, 1206 STYLE, SR
481045	1	DIODE, ZENER, BZT52-C5V1, 5.1V
481546	3	DIODE, MMBD914L, SWITCHING, SURFACE MOUNT
481549	2	DIODE, MBRS140T3, RECTIFIER, SURFACE MOUNT
482601	1	LED, YELLOW, ROUND, .100 SPACING, PC MOUNT
482602	1	LED, GREEN, ROUND, .100 SPACING, PC MOUNT
482603	1	LED, BICOLOR, RED/YELLOW, ROUND, 3 LEAD, PC M
482604	1	LED, BICOLOR, RED & GREEN, ROUND, 3 LEAD, PC
483020	1	TRANSISTOR, FMMT717, PNP, SOT23 CASE, SURFACE
484060	2	TRANSISTOR, MMBT3904T, NPN, SURFACE MOUNT
486042	1	IC, AT93C66-10SC, SERIAL 4K EEPROM, 8 PIN, SR

Part No.	QPA	Description
486820	1	IC, BQ2004SN, FAST CHARGE, 16 PIN, SURFACE MOUNT
515085	1	FUSE W FUSEHOLDER, 2A, 125V, SLO-BLO, SUBMIN
515087	1	FUSE W FUSEHOLDER, 1A, 125V, SLO-BLO, SUBMIN

2739-01 Battery & Comm Interface Board Assembly

Line No.	Part No.	QPA	Description
0001	2739-02	1	FAB, BATTERY & COMM INTERFACE BOARD
0002	2739-03	0	SCHEMATIC, BATTERY & COMM INTERFACE BD
0008	211512	2	CONNECTOR, 5 PIN, HEADER, STRAIGHT, .1 SP
0009	211638	1	CONNECTOR, 6 PIN, RECEPTACLE, MOD CONTACT

6700-00 $ETCO_2$ Monitor, Model 610

Line No.	Part No.	Rev.	QPA	Description
0002	6700-01	01	1	MAIN ASSY, MODEL 610 - TIDAL WAVE
0004	6700-09	00	0	OVERALL WIRING DIAGRAM, MODEL 610
0005	6700-23	01	0	USERS MANUAL, MODEL 610
0011	6834-32	02	1	LABEL, PATIENT ISOLATION, MODEL 610
0012	6874-32	00	1	LABEL, SERIAL NO. & BATTERY ALIGNMENT
0013	6878-32	01	1	QUICK GUIDE LABEL, BOTTOM COVER, MODEL 610
0014	6886-13	00	1	CARTON, SHIPPING, HAND HELD MONITOR
0016	6920-13	00	1	SHIPPING CARTON, ACCESSORIES, MODEL 610
0020	240059		0	SCREW COVER, BLK, PVC, .25DIA X .06T, ACRYLIC
0021	315033		0	POUCH, PLASTIC, ZIP LOCK, 4" X 6", 2 MIL THICK

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Section 12 *Drawings and Schematics*

TIDAL WAVE (Model 610) ***Hand-Held Capnography***

Below is a list of schematics and drawings for the TIDAL WAVE Hand-Held Capnograph, Model 610 (Cat. No. 6700-00).

Drawing No.	Code	Description	Sheets
6700	09	Overall Wiring Diagram	1
6700	00	ETCO2 Monitor, Model 610 - TIDAL WAVE	1
6700	01	Main Assembly, Model 610 - TIDAL WAVE	3
2738	17/01	Main Board Assembly, Main Board Subassembly	3
2738	03	Model 610 Main Board	7
2737	01	Interface Board Assembly, Model 610 - TIDAL WAVE	1
2737	03	Model 610 Interconnect Board	1

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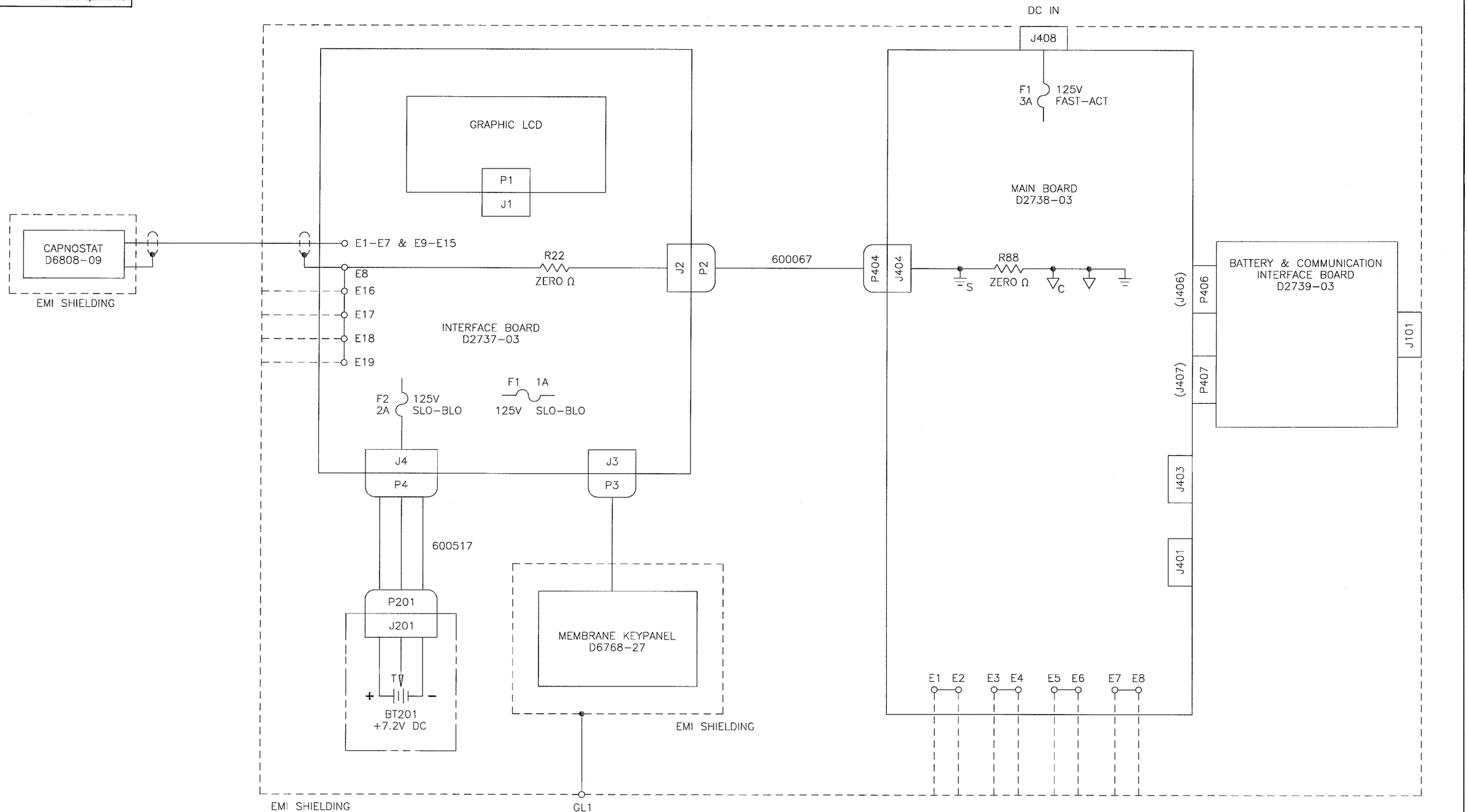

REV	R NO.	DATE	DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC ± ~ (mm) ± ~ FRAC ± ~ (mm) ± ~ HOLES +.007 -.003 (mm) (+.18 -.08) ANG ± ~ MATERIAL ~ FINISH ~	TITLE OVERALL WIRING DIAGRAM, MODEL 610 - TIDAL WAVE DRAWN 2:00etDE M.R. Linebeck CHECKED MFG ENGR APPROVED USED ON: D6700-00	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492 SIZE D DRAWING NO. 6700 CODE 09 REV 00 SCALE: NONE SHEET 1 OF 1

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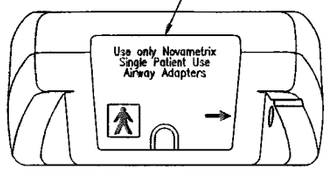
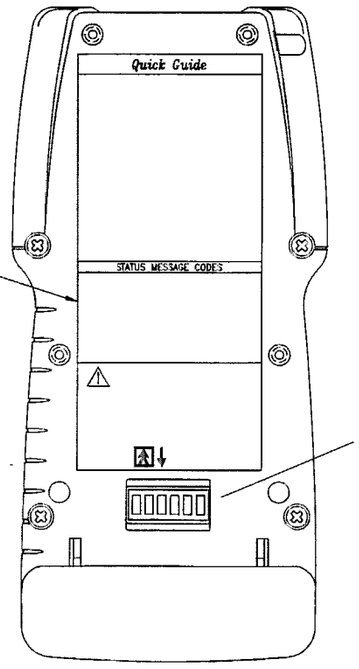
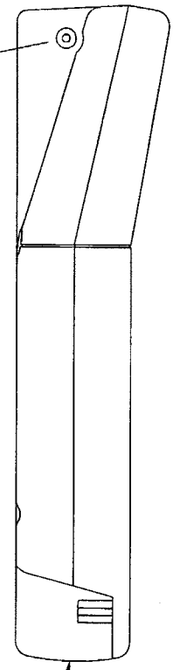


(11) LOCATE PATIENT ISOLATION LABEL ON TOP COVER NOTE ORIENTATION

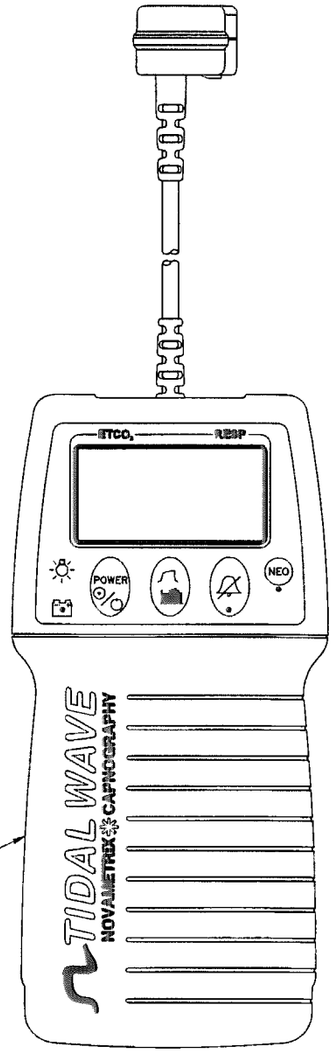


LOCATE QUICK GUIDE LABEL ON BOTTOM COVER. NOTE ORIENTATION (13)

J101

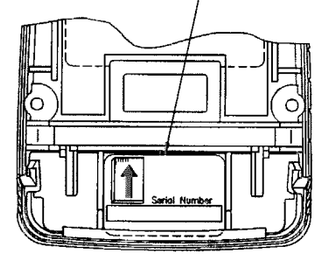


SEE DETAIL A FOR SN LABEL LOCATION



MAIN ASSY (2)

(12) LOCATE SN LABEL INSIDE BOTTOM COVER NOTE ORIENTATION



DETAIL A

NOTES:

1. FOR SYSTEM TEST PROCEDURE SEE A6700-04.
2. FOR QA TEST PROCEDURE SEE A6700-70.
3. FOR SHIPPING INSTRUCTIONS SEE A6700-33.
4. FOR OVERALL WIRING DIAGRAM SEE D6700-09.
5. THE FOLLOWING ITEMS ARE TO BE INCLUDED WITH MONITOR. REFER TO SHIPPING INSTRUCTIONS.
   A. ITEM 5: USERS MANUAL; QTY: 1
   B. ITEM 20: SCREW COVER, BLACK; QTY: 6 (PLACE IN POUCH)
   C. ITEM 21: POUCH, PLASTIC, ZIP LOCK; QTY: 1

REV	R NO.	DATE
02	N511	23Sep97
01	N486	14Jul97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES +.007 -.003 (mm) (± ~)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: ETCO2 MONITOR, MODEL 610 - TIDAL WAVE

DRAWN 8Feb97 M.R. Lineback | CHECKED JAT 4/7/97
MFG ENGR MJC 4/4/97 | APPROVED AJE 4/7/97
USED ON: ~

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	6700	00	02

SCALE: 1/1 SHEET 1 OF 1

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INSTALL KEYPANEL FILLER FROM FRONT (7)

ATTACH MEMBRANE KEYPNL TO TOP COVER USING ADHESIVE BACKING (4)

(10) TOP COVER WITH SHIELDING

BEND RIBBON CABLE & GROUND STRAP DOWN TO REAR OF KEYPANEL AND ALLOW TO SPRING BACK

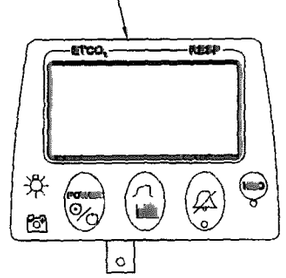
P3

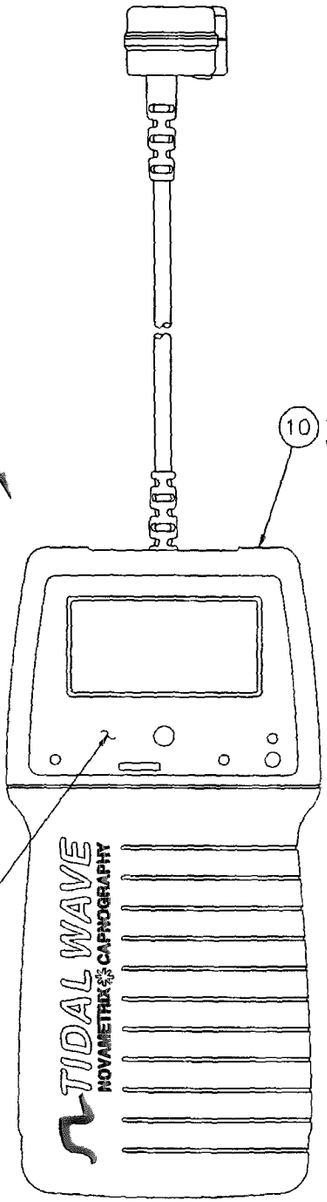
.550 REF

.350 ±.030

BEND END OF GROUND STRAP TO EDGE OF KEYPANEL & CREASE

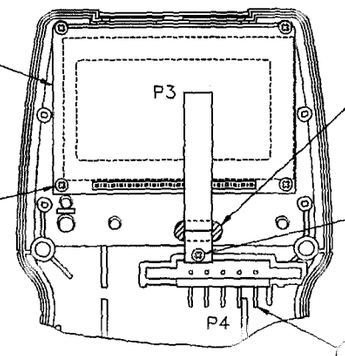
CLEAN KEYPANEL RECESS WITH ISOPROPYL ALCOHOL AND ALLOW TO DRY (12)





INSTALL LCD DISPLAY NOTE ORIENTATION (17)

SECURE LCD DISPLAY TO TOP COVER. 4 PL (15)



(14) APPLY A BEAD OF RTV COMPLETELY AROUND GROUND STRAP AND RIBBON CABLE INSURING THAT ALL VOIDS ARE FILLED. CURE AT ROOM TEMPERATURE FOR 24 HOURS

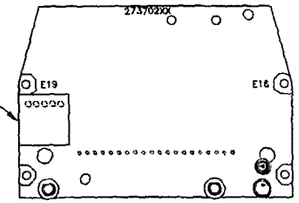
(15) SECURE BATTERY CABLE AND KEYPANEL GROUND STRAP

(19) BATTERY CABLE WIRES NOT SHOWN

DETAIL B

DETAIL A

5/8 IN. X 5/8 IN. COVER J4 PINS WITH TAPE APPROX AS SHOWN. DO NOT COVER E19 CONDUCTIVE AREA (13)



DETAIL E

(6) TRANSDUCER ASSY

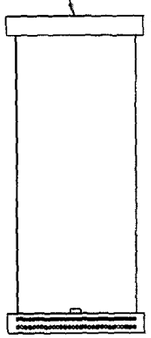
FLAT SIDE UP

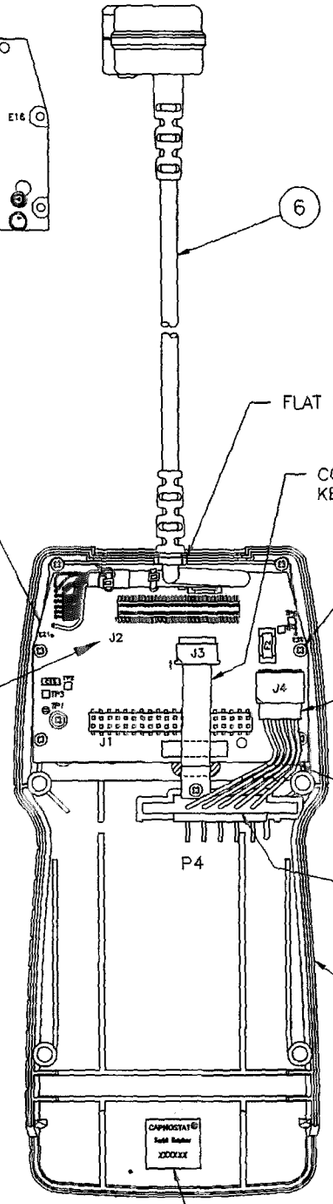
SEE DETAIL E FOR 2737 BOARD SUBASSY PART OF ITEM 6

CONNECT RIBBON CABLE FROM KEYPANEL TO 2737–J3

(15) SECURE 2737 BOARD TO TOP COVER 4 PL

CONNECT RIBBON CABLE TO 2737–J2 (18)





CONNECT BATTERY CABLE TO 2737–J4

DRESS WIRES TO THE RIGHT APPROX AS SHOWN. TUCK EXCESS WIRES DOWN AND BETWEEN 2737 BD & BATTERY CONNECTOR

BATTERY CABLE WIRES MUST BE KEPT BEHIND THIS SURFACE

SEE DETAIL B FOR LCD AND TOP COVER SUBASSY

PART OF ITEM 6
LOCATE CAPNOSTAT SN LABEL ON TOP COVER APPROX AS SHOWN

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES FRAC ± ~ mm ± ~ TRAC ± ~ (mm) ± ~ HOLES: +.007 −.003 (mm) ± ~ ANG ± ~	TITLE: MAIN ASSY, MODEL 510 – TIDAL WAVE	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			MATERIAL ~	DRAWN 6Feb97 M.R. Linebeck	CHECKED JAT 4/7/97
01	N511	24Sep97	FINISH ~	MFG ENGR MJC 4/4/97	APPROVED AJE 4/7/97
REV	R NO.	DATE		USED ON: D6700-00	SCALE: 1/1

SIZE	DRAWING NO.	CODE	REV
D	6700	01	01

SHEET 2 OF 3

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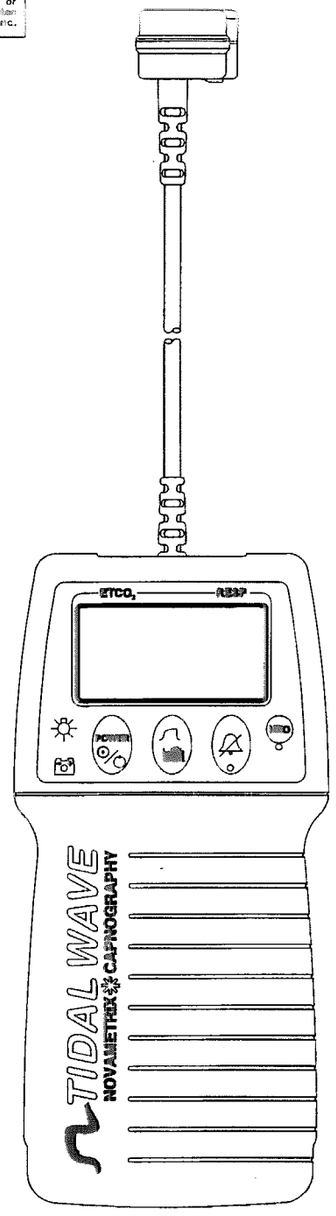
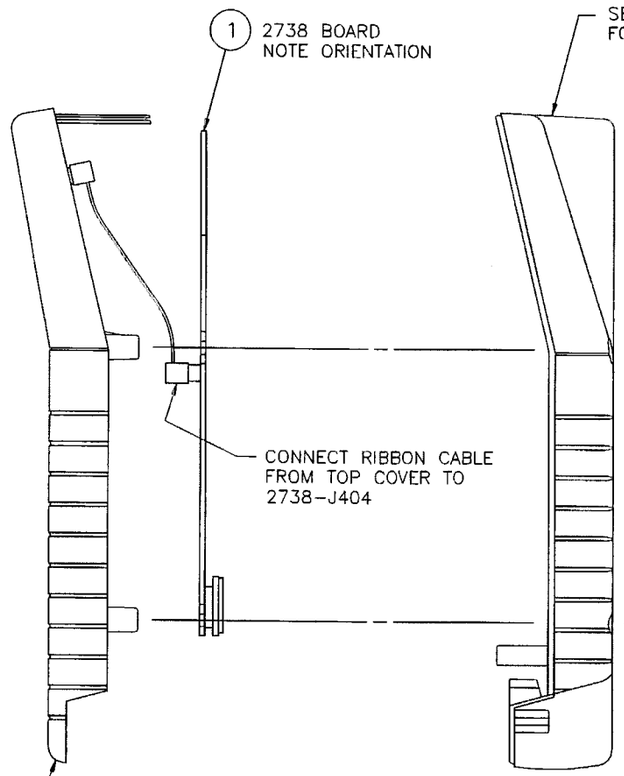
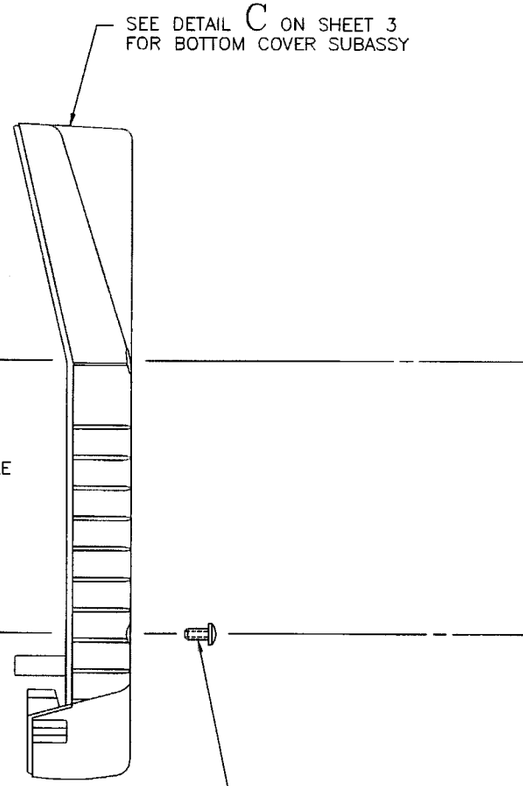
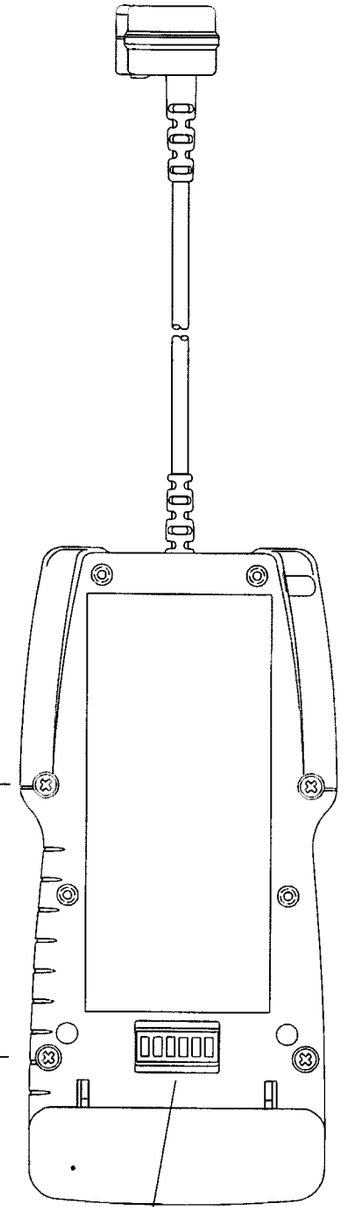



1
2738 BOARD NOTE ORIENTATION
CONNECT RIBBON CABLE FROM TOP COVER TO 2738-J404
SEE DETAIL A ON SHEET 2 FOR TOP COVER SUBASSY





			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC ± ~ (mm) (± ~) FRAC ± ~ (mm) (± ~) HOLES +.007 −.003 (mm) (± ~) ANG ± ~	TITLE: MAIN ASSY, MODEL 610 – TIDAL WAVE	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
			MATERIAL ~	DRAWN 14Mar97 M.R. Lineback	CHECKED JAT 4/7/97
01	N511	24Sep97	FINISH ~	MFG ENGR MJC 4/4/97	APPROVED AJE 4/7/97
REV	R NO.	DATE		USED ON: 06700-00	SCALE: 1/1

SIZE	DRAWING NO.	CODE	REV
D	6700	01	01

SHEET 1 OF 3

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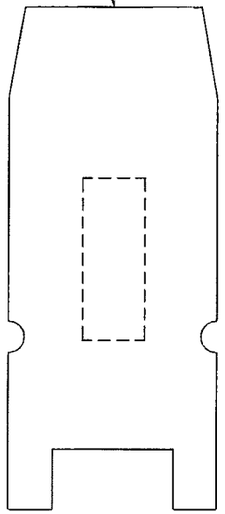
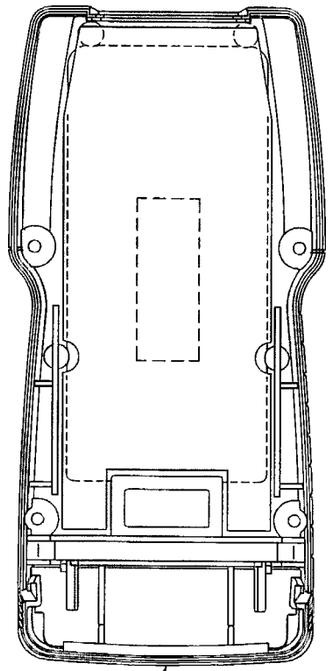
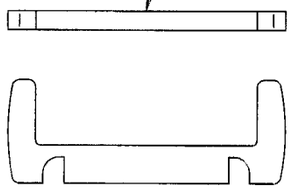
(5) LOCATE SHIELD IN BOTTOM COVER AND SECURE USING ADHESIVE BACKING APPROX AS SHOWN



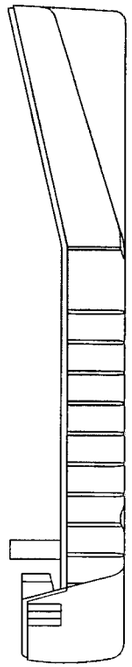


SEE DETAIL D FOR BATTERY DOOR SUBASSY

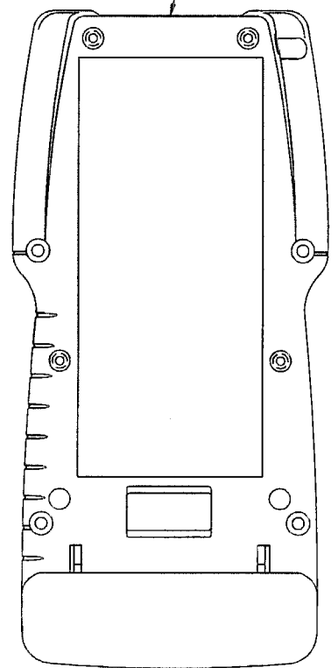
(9) LOCATE BATTERY GASKET IN BOTTOM COVER WITH ORIENTATION SHOWN



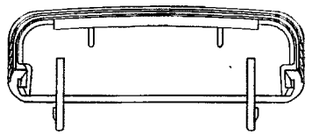
BOTTOM SIDE



(2) BOTTOM COVER WITH SHIELDING

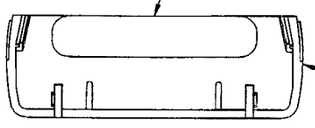


SNAP BATTERY DOOR ONTO BOTTOM COVER



DETAIL C

(8) LOCATE GASKET ON BATTERY DOOR AND SECURE USING ADHESIVE BACKING APPROX AS SHOWN



(3) BATTERY DOOR

DETAIL D

			DO NOT SCALE UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm) BREAK ALL SHARP EDGES TOLERANCES DEC: X ~ (mm) (± ~) FRAC: ± ~ (mm) (± ~) HOLES: +.007 -.003 (mm) (± ~) ANG: ± ~ MATERIAL ~ FINISH ~	TITLE: MAIN ASSY, MODEL 610 - TIDAL WAVE	NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492
				DRAWN 8Feb97 M.R. Linebeck	CHECKED JAT 4/7/97
				MFG ENGR MJC 4/4/97	APPROVED AJE 4/7/97
01	N511	24Sep97		USED ON: 06700-00	SCALE: 1/1
REV	R NO.	DATE		SIZE D	DRAWING NO. 6700 CODE 01 REV 01
					SHEET 3 OF 3

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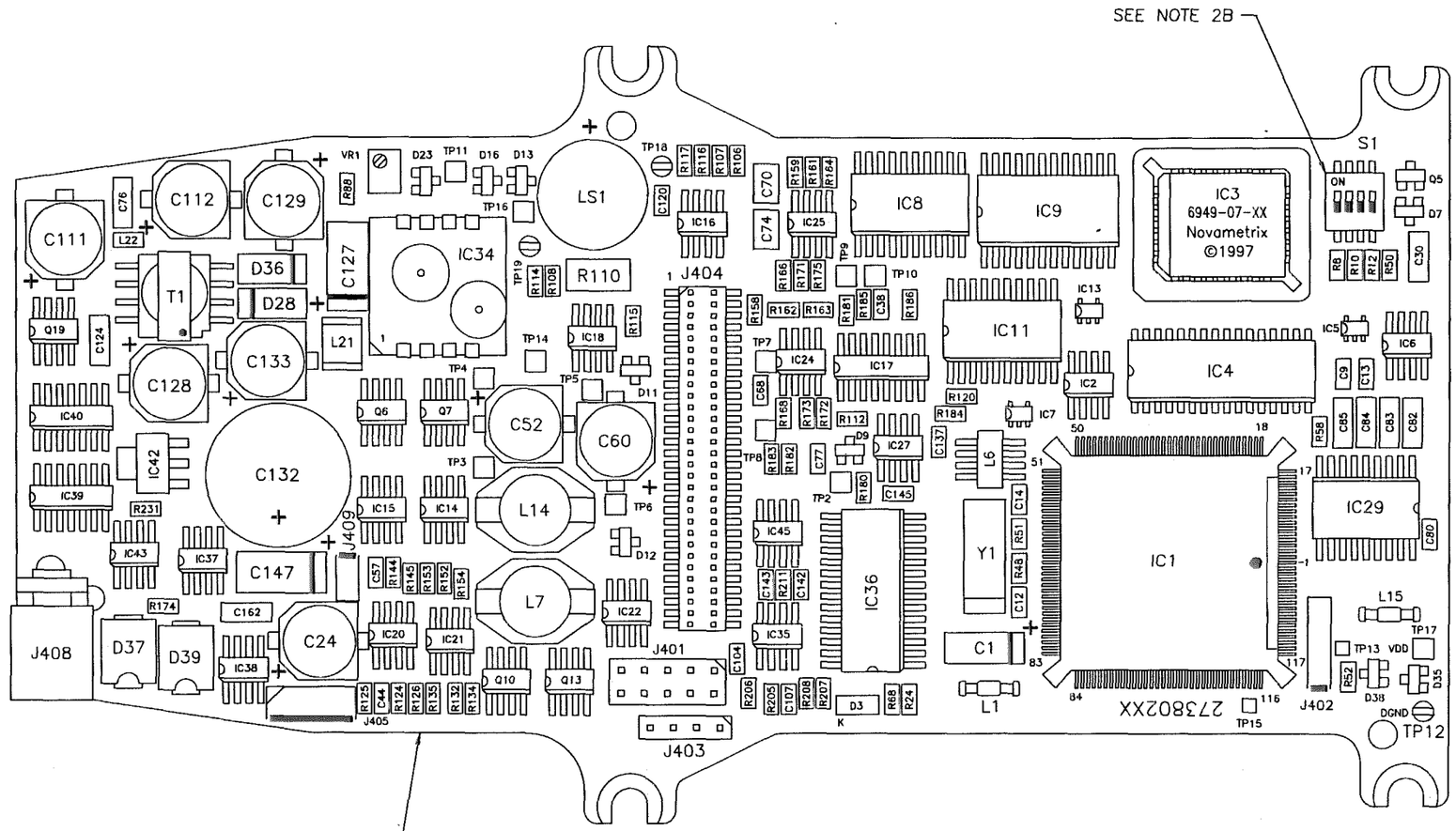

NOTES:

1. D2738-17 SPECIFICATIONS – COMPONENTS NOT FITTED: J402, J405, J409, R93, C157A, C158A, C159A, R195
2. D2738-01 SPECIFICATIONS:
   A. SET S1 AS SHOWN.
   B. FOR TEST PROCEDURE SEE A2738-04.

DRAWING TABULATION		
DWG NO.	TITLE	NEXT ASSY
D2738-01	MAIN BOARD ASSY, MODEL 610 – TIDALWAVE	D6700-00
D2738-17	MAIN BOARD SUBASSY, MODEL 610 – TIDALWAVE	D2738-01

REV	R NO.	DATE
03	N519	21Oct97
02	N486	14Jul97
01	N471	14May97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES +.007 -.003 (mm) (± ~)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 610 – TIDAL WAVE

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

DRAWN BL 10Jan97 | CHECKED MRL 7Apr97
MFG ENGR MJC 4/7/97 | APPROVED AJE 4/7/97
USED ON: SEE TABULATION

SIZE D | DRAWING NO. 2738 | CODE 17 01 | REV 03
SCALE: NONE | SHEET 1 OF 3

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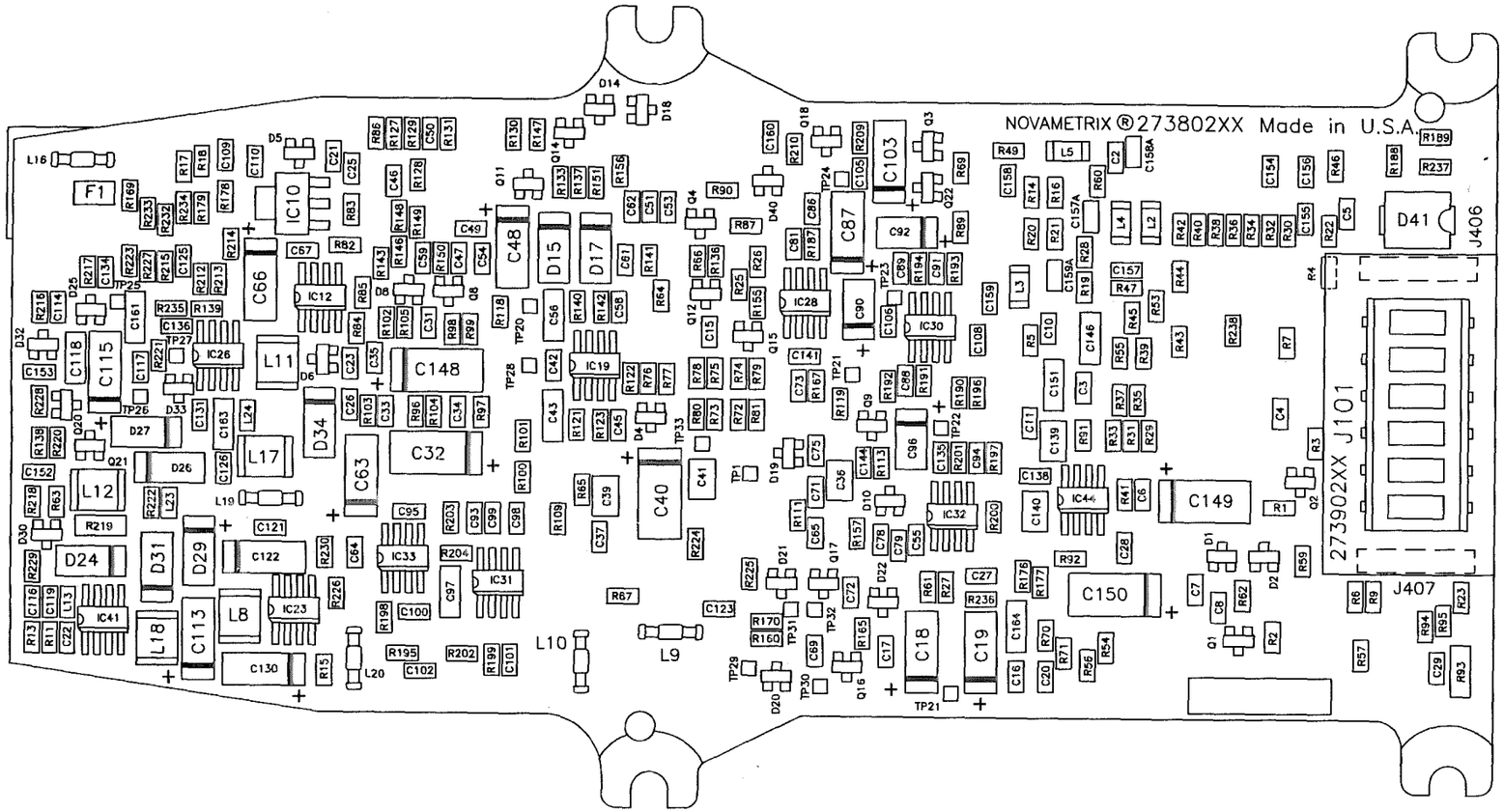

D2738-01
LOCATE CONNECTOR CRADLE
GASKET OVER 2739-J101
WHILE NOTING ORIENTATION

DRAWING TABULATION

DWG NO.	TITLE	NEXT ASSY
D2738-01	MAIN BOARD ASSY, MODEL 610 - TIDAL WAVE	D6700-00
D2738-17	MAIN BOARD SUBASSY, MODEL 610 - TIDAL WAVE	D2738-01

REV	R NO.	DATE
03	N519	21Oct97
02	N486	14Jul97
01	N471	14May97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
MATERIAL ~
FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 610 - TIDAL WAVE

NOVAMETRIX MEDICAL SYSTEMS INC. WALLINGFORD, CT U.S.A. 06492

DRAWN	CHECKED
BL 10Jan97	MRL 7Apr97
MFG ENGR MJC 4/7/97	APPROVED AJE 4/7/97

USED ON: SEE TABULATION

SIZE	DRAWING NO.	CODE	REV
D	2738	17 01	03

SCALE: NONE

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D2738-01 ASSEMBLY

PN	DESCRIPTION	REF DES
D2738-03	SCHEMATIC, MAIN BOARD, 610	~
A2738-04	TEST PROCEDURE, MAIN BD, 610	~
D2738-17	MAIN BOARD SUBASSY, MODEL 610	~
B6837-10	GASKET, CONNECTOR CRADLE, 101 & 610	(FOR 2739-J101)
A6949-07	PROGRAM, FLASH PEROM W BOOT CODE & SYS	IC3

D2738-17 SUBASSEMBLY

PN	DESCRIPTION	REF DES
2738-02	FAB, MAIN BOARD, MODEL 610	~
B2739-01	BATTERY & COMM INTERFACE BOARD ASSY	(FOR J406, J407)
☆ 130015	TRANSDUCER, AUDIO, 2400 Hz, 12V, 40mA	LS1
☆ 152085	CAPACITOR, 1500uF, 16V, ELECTROLYTIC	C132
152096	CAPACITOR, 220uF, 35V, 20%, ELECTROLYTIC	C24, C52, C60, C111, C112, C128, C129, C133
154072	CAPACITOR, .1uF, 50V, 10%, X7R	C30, C43, C56, C76, C82-C85, C97, C118, C124, C146, C151, C161, C162, C163, C164
154079	CAPACITOR, 10uF, 25V, 10%, TANTALUM	C1, C18, C19, C48, C87, C103
154086	CAPACITOR, 4.7uF, 10VDC, 20%, TANTALUM	C90, C92, C96
154093	CAPACITOR, 68uF, 16VDC, 10%, TANTALUM	C32, C40, C127, C147-C150
154103	CAPACITOR, .001uF, 50VDC, 10%, X7R	C121
154104	CAPACITOR, .01uF, 50VDC, 10%, X7R	C10, C29, C33, C34, C38, C44, C50, C53, C55, C57, C59, C62, C65, C71, C73, C75, C78, C79, C86, C91, C94, C99, C100, C114, C117, C131, C136, C143, C160
154105	CAPACITOR, 47pF, 50VDC, 5%, NPO	C137, C145
154106	CAPACITOR, 22pF, 50VDC, 5%, NPO	C12, C14
154108	CAPACITOR, 100pF, 50VDC, 5%, MLTILYR CER	C154, C155-C159
154111	CAPACITOR, .1uF, 16VDC, 5%, 1210 CASE	C36, C39, C41, C70, C74, C139, C140
154112	CAPACITOR, .047uF, 16VDC, 10%, X7R	C2-C9, C11, C13, C15-C17, C20-C23, C25-C28, C31, C35, C37, C42, C45-C47, C49, C51, C54, C58, C61, C64, C67-C69, C72, C77, C80, C81, C86, C89, C93, C95, C98, C101, C102, C104-C110, C116, C120, C123, C125, C126, C134, C135, C138, C141, C142, C144, C152, C153
154113	CAPACITOR, 4700pF, 50VDC, 10%, X7R	C119
154116	CAPACITOR, 10uF, 35V, 10%	C63, C66, C113, C115, C122, C130
180022	INDUCTOR, 10uH, 10%	L8, L11, L12, L17, L18, L21
180029	INDUCTOR, 50MHz CUT-OFF FREQUENCY	L2-L5
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1, L9, L10, L15, L16, L19, L20
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L6
180043	FERRITE BEAD, 30 OHMS AT 100MHz	L13, L22-L24
180045	INDUCTOR, 220uH, 20%, .53 OHM, 15% DCR	L7, L14
☆ 210141	CONNECTOR, DC POWER JACK	J408
☆ 211407	CONNECTOR, 4 PIN, HEADER, .100 SPACING	J403
☆ 212108	CONNECTOR, 10 PIN, HEADER, DUAL ROW, .1 SP	J401
213900	CONNECTOR, 60 PIN, HEADER, .05 X .1 SP	J404
215073	SOCKET, PLCC, 32 PIN, .05 SPACING	(FOR IC3)
☆ 216029	TEST POINT, SPRING LOADED, 475° C MAX	TP12, TP18, TP19
230024	CRYSTAL, 32.768kHz	Y1
474194	RESISTOR, 2.2M OHM, 1/16W, 5%	R135, R153
474197	RESISTOR, 49.9k OHM, 1/16W, 1%	R63, R107, R117, R125, R127, R143, R146, R157, R158, R167, R168, R218
474198	RESISTOR, 2.49k OHM, 1/16W, 1%	R122, R123, R141, R142
474222	RESISTOR, 10 OHM, 1/16W, 1%	R20, R21, R87, R187
474224	RESISTOR, 100 OHM, 1/16W, 1%	R61, R69, R89, R90, R111, R112, R118-R120, R128, R136, R148, R155, R165, R181, R185, R186, R192, R194, R201, R202, R210, R224
474225	RESISTOR, 499 OHM, 1/16W, 1%	R83, R96, R97, R137, R156, R180, R184, R198, R221
474227	RESISTOR, 1k OHM, 1/16W, 1%	R77-R81, R94, R160, R170, R188, R189
474229	RESISTOR, 2.05k OHM, 1/16W, 1%	R67, R68, R222, R225, R229
474230	RESISTOR, 3.32k OHM, 1/16W, 1%	R131, R150
474231	RESISTOR, 4.99k OHM, 1/16W, 1%	R3, R5, R121, R139, R140, R197
474233	RESISTOR, 10k OHM, 1/16W, 1%	R4, R6, R7, R9, R22-R47, R49, R50, R52-R60, R62, R64-R66, R72-R76, R98-R106, R114, R116, R138, R169, R182, R183, R190, R191, R193, R196, R200, R206, R209, R228, R237, R238
474234	RESISTOR, 20.5k OHM, 1/16W, 1%	R129, R149
474235	RESISTOR, 24.9k OHM, 1/16W, 1%	R126, R145, R205, R207
474236	RESISTOR, 33.2k OHM, 1/16W, 1%	R132, R152, R208, R211
474238	RESISTOR, 37.4k OHM, 1/16W, 1%	R230
474239	RESISTOR, 75k OHM, 1/16W, 1%	R166, R203, R204
474240	RESISTOR, 100k OHM, 1/16W, 1%	R1, R2, R8, R10, R12, R14, R16, R19, R70, R71, R109, R124, R130, R134, R144, R147, R154, R164, R171, R175, R216, R217, R231, R232
474241	RESISTOR, 150k OHM, 1/16W, 1%	R85, R115, R199, R226 R227, R233
474242	RESISTOR, 249k OHM, 1/16W, 1%	R48
474243	RESISTOR, 324k OHM, 1/16W, 1%	R15, R84
474245	RESISTOR, 1M OHM, 1/16W, 1%	R113, R133, R151, R174, R176, R177
474247	RESISTOR, 10M OHM, 1/16W, 5%	R51
474250	RESISTOR, 43.2k OHM, 1/16W, 1%	R161
474251	RESISTOR, 61.9k OHM, 1/16W, 1%	R11, R108, R212
474253	RESISTOR, 4.32k OHM, 1/16W, 1%	R82
474256	RESISTOR, 0 OHM, 0603 STYLE	R86, R88, R91, R92, R178, R220, R234
474257	RESISTOR, 1 OHM, .5W, 1%, 2010 SIZE	R110
474259	RESISTOR, 15k OHM, 1/16W, 1%	R95, R163, R173
474261	RESISTOR, 7.5k OHM, 1/16W, 1%	R162, R172
474266	RESISTOR, 4.75k OHM, 1/16W, 1%	R219
474267	RESISTOR, 6.19k OHM, 1/16W, 1%	R13
474269	RESISTOR, 121k OHM, 1/16W, 1%	R159, R215
474270	RESISTOR, 200k OHM, 1/16w, 1%	R17, R18, R213, R223, R235, R236
474283	RESISTOR, 392k OHM, 1/16w, 1%	R214
475052	POTENTIOMETER, 1k OHM, 10%, MULTI-TURN	VR1
481546	DIODE, MMBD914L, SWITCHING	D4, D7, D9, D25, D30, D32, D33, D40
481547	DIODE, BAT54, HOT CARRIER SCHOTTKY	D1, D2, D10, D11
481548	DIODE, EGL41B, RECTIFIER, SILICON	D26-D28, D36
481549	DIODE, MBRS140T3, RECTIFIER	D15, D17, D24, D29, D31, D34
481552	DIODE, MBRS340T3, SCHOTTKY, 40V, 3A	D37, D39, D41
481554	DIODE, BAV70LT1, DUAL COMMON CATHODE, 70V	D8, D12, D19, D22
481555	DIODE, MMBD7000LT1, DUAL SWITCHING	D5, D6, D13, D14, D16, D18, D20, D21, D23, D35, D38
482551	LED, RED, WITH LENS	D3
483019	TRANSISTOR, MMBT2907ALT1, PNP, SOT-23	Q18
484060	TRANSISTOR, MMBT3904T, NPN	Q4
484562	IC, LT1175CS8-ADJ, MICROPOWER REGULATOR	IC12, IC23
484563	IC, LT1117CST, VOLTAGE REGULATOR, POS, 3 PIN	IC10, IC42
484567	VOLTAGE REGULATOR, LT1372CS8, 35V, 8 PIN	IC41
484569	VOLTAGE REGULATOR, LT1375CS8-5, 8 PIN	IC26
485532	TRANSISTOR, 2N7002T1, N-CHAN ENHAN MODE	Q1-Q3, Q5, Q8, Q9, Q11, Q12, Q14-Q17, Q20-Q22
485541	TRANSISTOR, SI9947DY, MOSFET, DUAL P-CH ENH	Q10, Q13, Q19
485543	TRANSISTOR, SI9952DY, MOSFET, N-CH & P-CH	Q6, Q7
486038	IC, MC68332FC, MICROPROCESSOR, 132 PIN	IC1
486042	IC, AT93C66-10SC, SERIAL 4k EEPROM, 8 PIN	IC2
486050	IC, AS7C512-20JC, 64k X 8 RAM, 20nS ACCESS	IC4
486323	IC, SN74HC573DW, OCTAL D-TYPE LATCH	IC11
486325	IC, MC14093BD, QUAD 2-IN SCHMITT TRIGGER	IC39
486326	IC, MC14013BD, DUAL D FLIP-FLOP	IC40
486340	IC, TLC2543CDW, 12-BIT A TO D CONVERTER	IC8
486346	IC, TC7S00FTE85L, 2-IN NAND GATE, CMOS	IC5, IC7, IC13
486354	IC, LTC1384CSW, LOW POWER RS232 RECEIVER	IC29
486790	IC, TLE2022CD, DUAL OP AMP, HI SPEED, L PWR	IC16, IC24, IC25, IC27, IC30, IC35, IC45
486796	IC, TLC2272CD, DUAL OP AMP, RAIL TO RAIL	IC19, IC20, IC32
486805	IC, LM393M, DUAL VOLTAGE COMP, LOW PWR	IC18, IC21, IC43
486807	IC, SMP04ES, QUAD SAMPLE & HOLD AMP	IC17
486808	IC, AD680JR, 2.5 VOLTAGE REF, LOW POWER	IC28
486811	IC, TLC2262AIDR, DUAL OP AMP, RAIL TO RAIL	IC37
486819	IC, AD7564BR, 12-BIT D TO A CONV, QUAD	IC36
486823	IC, LT1490CS8, RAIL TO RAIL OP AMP, 14 PIN	IC31, IC44
486821	IC, AD822AR, FET-IN OP AMP, L POWER, 8 PIN	IC31, IC44 ALTERNATE
487085	IC, MAX872CSA, 2.5V PREC VOLTAGE REF	IC38
487094	IC, RTC-62423, REAL TIME CLOCK W QTZ XTAL	IC9
487100	IC, TC1426COA, INV DUAL MOSFET DRVR, 1.2A	IC22
☆ 487102	IC, 1220A-015A-3N, PRESSURE SENSOR, 8 PIN	IC34
487103	IC, TC4405COA, DUAL OD FET DRVR, NON-INV	IC15
487104	IC, TC4404COA, DUAL OD FET DRVR, INV, 1.5A	IC14
487108	IC, TL7757CD, VOLTAGE SUPERVISOR, 8 PIN	IC6
487115	IC, AD620BR, INSTR AMPLIFIER, L POWER, 8 PIN	IC33
513010	SWITCH, SLIDE, SPDT, 4 SWITCHES, .050 SPACING	S1
515092	FUSE, 3A, 32V, VERY FAST-ACT, 1206 STYLE	F1
560009	TRANSFORMER, 10uH 20% ❂ .1VRMS, 100k Hz	T1

☆ DENOTES THRU HOLE COMPONENTS

DRAWING TABULATION

DWG NO.	TITLE	NEXT ASSY
D2738-01	MAIN BOARD ASSY, MODEL 610 - TIDAL WAVE	D6700-00
D2738-17	MAIN BOARD SUBASSY, MODEL 610 - TIDAL WAVE	D2738-01

REV	R NO.	DATE
03	N519	21Oct97
02	N486	14Jul97
01	N471	14May97

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES +.007 -.003 (mm) (± ~)
ANG ± ~
MATERIAL ~
FINISH ~

TITLE: MAIN BOARD ASSY, MODEL 610 - TIDAL WAVE

DRAWN BL 10Jan97 | CHECKED MRL 7Apr97
MFG ENGR MJC 4/7/97 | APPROVED AJE 4/7/97
USED ON: SEE TABULATION

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE D | DRAWING NO. 2738 | CODE 17 01 | REV 03
SCALE: NONE | SHEET 3 OF 3

MVDD
L1
61R30T
VDD
IC1
MC68332
C1
10u
Tant
25V
C2
.047u
C3
.047u
C4
.047u
C5
.047u
VSTBY
VDD
VSS
T2CLK
TP0
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
MODCLK/PF0
IRQ1*/PF1
IRQ2*/PF2
IRQ3*/PF3
IRQ4*/PF4
IRQ5*/PF5
IRQ6*/PF6
IRQ7*/PF7
BERR*
HALT*
RESET*
MISO
MOSI
SCK
PCS0*/SS*
PCS1*
PCS2*
PCS3*
TxD
RxD
CLKOUT
VDDSYN
XFC
EXTAL
XTAL
CO2AZ
CO2PWENB
SRCDRV0
CS*/H
SRCDRV1
SS*/H
CASEPWM
DETPWM
SW1
SW2
SW3
SW4
TOUT1
BACKLITE
DACLD*
LED
AUD_EN
CASEOT
DETOT
EXTDCIN
PWRKEY
NMI*
SSDI
SSDO
SSCLK
ADCCS*
DACCS*
E2CS
EECS
ASTxD
ASRxD
T2CLK
SYSCLKO*
L3
51R00P
C146
0.1u
C10
0.01u
C151
0.1u
C12
22p
R48
249K
C14
22p
Y1
32.768KHz
R51
10M
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
L2
CSBOOT*
BR*/CS0*
BG/CS1*
BACK/CS2*
FC0/CS3*
FC1/CS4*
FC2/CS5*
A19/CS6*
A20/CS7*
A21/CS8*
A22/CS9*
A23/CS10*
SIZ1/PE7
SIZ0/PE6
AS*/PE5
DS*/PE4
RMC*/PE3
AVC*/PE2
DS1*/PE1
DS0*/PE0
R/W*
IPIPE*
IFETCH*
BKPT*
TSTME*
FREEZE
BOOTCS*
SRAMWR*
SRAMRD*
ROMWR*
DISPCS1*
DISPCS2*
LEDCS*
RTCCS*
ROMWREN
ECLK
JP1*
JP0*
CNFG1*
CNFG0*
L6
F0418-1SR
WR*
RD*
ROMWR*
ROMWREN
VDD
R2
100K
Q1
2N7002
IC3
28C010/D20
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
D0
D1
D2
D3
D4
D5
D6
D7
NC/A17
NC/VPP
VCC
GND
OE
OE
WE
C8
.047u
ROMOE*
TP15
TP13
PROFILE*
C157A
C158A
L4
L5
AS*
DS*
51R00P
C11
.047u
IC7
TC7S00F
VBACK
VBACKUP
VDD
C149
Elect
68u
16V
C150
Elect
68u
16V
D1
MMBD301L
D2
MMBD301L
SRST*
R1
100K
Q2
2N7002
IC4
AS7C512-20JC
CS1
CS2
OE
WE
C7
.047u
SRAMOE*
SRAMWR*
IC6
TL7757
RST*
C13
.047u
IC5
TC7S00F
C9
.047u
RESET
SRST*
D[0:15]
A[0:17]
J403
TxDLS
RxDLS
TidalHost Interface
IC2
93C66
EECS
SSCLK
SSDO
SSDI
CS
SK
DI
DO
VDD
DC
ORG
GND
C6
.047u
BOOTCS*
ECLK
SRAMRD*
AS*
DS*
SYSCLKO
SYSCLKO*
C154
100pf
C155
100pf
C156
100pf
C157
100pf
C158
100pf
C159
100pf
C159A
SRST*
BKPT*
TST*
CNFG0*
CNFG1*
JP0*
JP1*
R3
4.99K
R5
4.99K
R8
100K
R10
100K
R12
100K
R14
100K
R16
100K
R20
10
R21
10
DACLD*
T2CLK
CO2AZ
CS*/H
SS*/H
TOUT1
BACKLITE
LED
CASEOT
DETOT
NMI*
SSDI
SSDO
SSCLK
ADCCS*
DACCS*
ASRxD
DS1*
AS*
DS*
BERR*
HALT*
TSTME*
ROMOE*
SRAMOE*
R238
R4
R6
R7
R9
R22
R23
R24
R25
R26
R28
R29
R31
R33
R35
R37
R43
R45
R47
R49
R50
R53
R55
R57
R59
R65
10K
CO2INH
D1
D2
D3
D4
D5
D6
D7
D10
D11
R30
R32
R34
R36
R38
R40
R42
R44
R46
E2CS
EEGS
D0
D8
D9
CO2PWENB
SYSUP
ROMWREN
CASEPWM
DETPWM
R39
R41
R52
R54
R56
R58
R60
R62
R64
R66
S1
SW-4
TST*
CNFG0*
CNFG1*
BERR*
D3
BR1101
R68
2.05k
R69
100
Q3
2N7002
LED
J402
Boot Select
J401
Background Mode
DS*
BERR*
BKPT*
FREEZE
SRST*
IFETCH*
IPIPE*

			MODEL 610 MAIN BOARD		Novametrix		
					Medical Systems, Inc.		
					1 Barnes Industrial Park Road		
					Wallingford, CT USA 06492		
			Drawn: J Espinosa 3 May 96	Checked: MK 4-10-97			
03	N519	9-21-97	Mfg Eng: MJC 4-10-97	Approved: AJE 4-10-97	Size B	Document Number 2738	Code 03	Rev 03
02	N486	7-14-97					
01	N471	5-20-97	File: SCHEMATIC1				Sheet 1 of 7
Rev.	"R" No.	By Date	Date: Tuesday, October 21, 1997				

A[0..17]
A[1..17]
D[0..15]
D[0..15]

J404
60 D0
59 D1
58 D2
57 D3
56 D4
55 D5
54 D6
53 D7
52 ECLK
51
50 WR*
49 SRST*
48 DISPCS1*
47 DISPCS2*
46
45
44
43
42 VDISP
41 VBACKLITE
40 BAT_1
39 BAT_2
38 ALR_1
37 ALR_2
36 NEO_LED
35
34
33
32
31
30
29
28
27
26 +VCHG
25
24
23
22
21

VDD
C15
.047u
+VBATT
VDD
R72 10K
R73 10K
R74 10K
R75 10K
R76 10K
PWRSW
D4
D914
R77 1K PWRKEY
R78 1K SW1
R79 1K SW2
R80 1K SW3
R81 1K SW4

System Interface

D8
D9
D10
D11
D12
D13
D14
D15
A0

R27 10K
C55 0.01u
+VA
C135
.047u
IC32A
TLC2272
R61 100
SWMUX
R67
2.05K

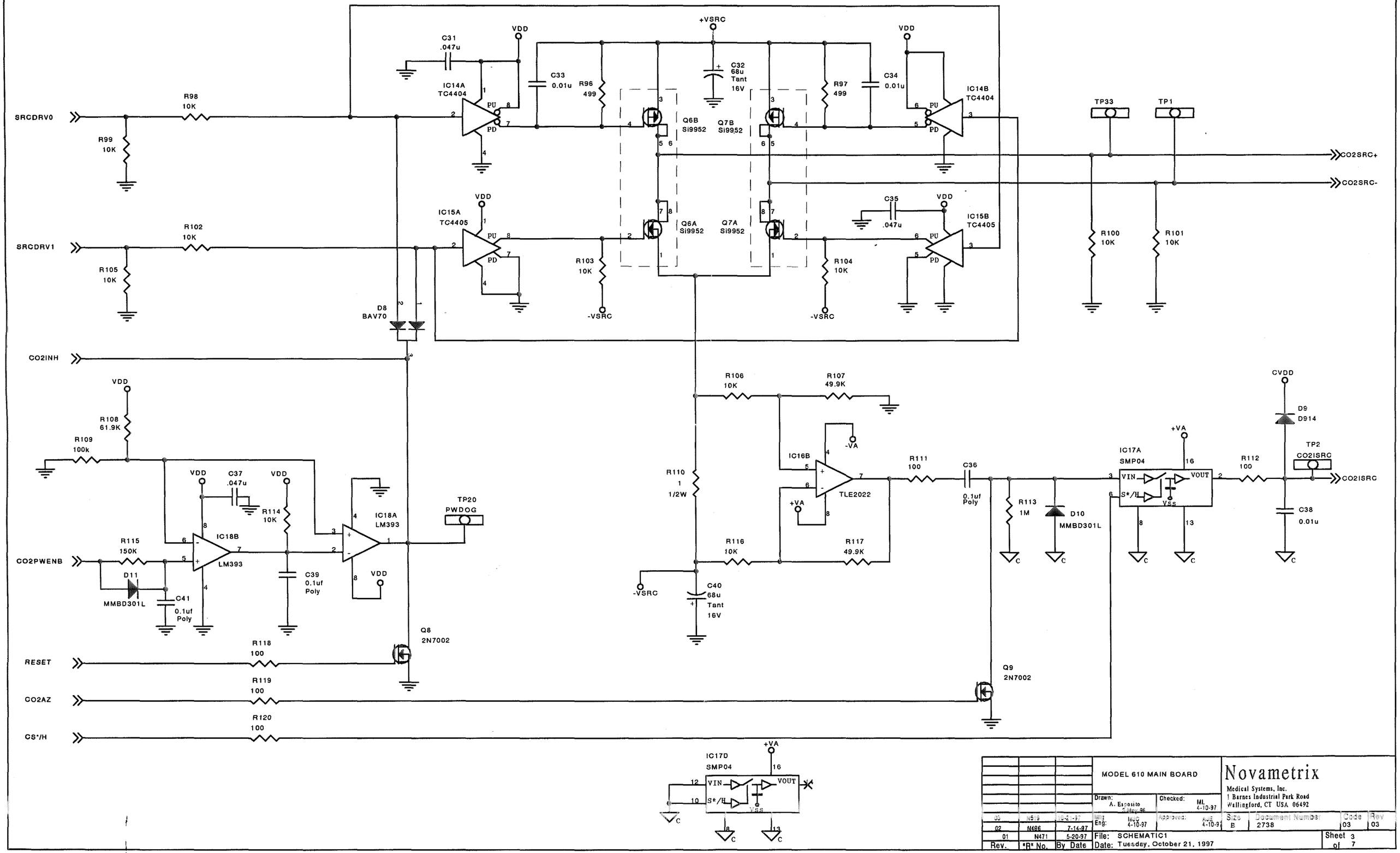
SSDI
IC8
CO2DATA
CO2REF
CO2SRC
CO2CASE
CO2DET
ABPRESS
VSPUMP
VBATTADC
R236 200K
C164
0.1u
1 A0
2 A1
3 A2
4 A3
5 A4
6 A5
7 A6
8 A7
9 A8
11 A9
12 A10
DOUT 15
14 REF+
13 REF-
ADCCS*
SSDO
15 CS
17 ADDIN
SSCLK
18 IOCLK
19 EOC
CVREF
CVDD
20 VCC
10 GND
C16 .047u
C19 10u Tant 25V
C17 .047u
C18 10u Tant 25V
TLC2543

IC9
RTC62423
A0
A1
A2
A3
D0
D1
D2
D3
RD*
WR*
RTCCS*
VCC 24
STD.P
ALE 4
CS1 20
XT
XT
GND 12
C20 .047u
VBACKUP
R70 100K
R71 100K
SRST*

IC11
74HC573
NEO_LED
BAT_1
BAT_2
ALR_1
ALR_2
COMMPWR
SAMPLE
SPARE
Q1 19
Q2 18
Q3 17
Q4 16
Q5 15
Q6 14
Q7 13
Q8 12
D1 2
D2 3
D3 4
D4 5
D5 6
D6 7
D7 8
D8 9
VCC 20
GND 10
C 11
OC 1
D[0:15]
VDD
C27 .047u
VDD
C28 .047u
IC13
LEDCS*
TC7S00F
BACKLITE
C30 0.1u
R94 1K
Q5 2N7002
R93
C29 0.01u
VBACKLITE
D7 D914
R95 15k

+VA
J405
1
2
3
4
SAMPLE
VSPUMP
Sampling Interface
R86 0 ohm

			MODEL 610 MAIN BOARD		Novametrix		
					Medical Systems, Inc.		
			Drawn: A.Esposito 3 May 96	Checked: ML 4-10-97	1 Barnes Industrial Park Road		
					Wallingford, CT USA 06492		
03	N519	10-21-97	Mfg: MJC 4-10-97	Approved: AJE 4-10-97	Size B	Document Number 2738	Code 03	Rev C3
02	N486	7-14-97	Eng:					
01	N471	5-20-97	File: SCHEMATIC1				Sheet 2 of 7	
Rev.	*R* No.	By Date	Date: Tuesday, October 21, 1997				



			MODEL 610 MAIN BOARD	Novametrix	
				Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492	
			Drawn: A. Esposito 5-May-96	Checked: ML 4-10-97	
03	N515	10-21-97	Mfg:	Approved: AJE 4-10-97	Size: B; Document Number: 2738; Code: 03; Rev: 03
02	N486	7-14-97	Eng: MWO 4-10-97		
01	N471	5-20-97	File: SCHEMATIC1		Sheet 3 of 7
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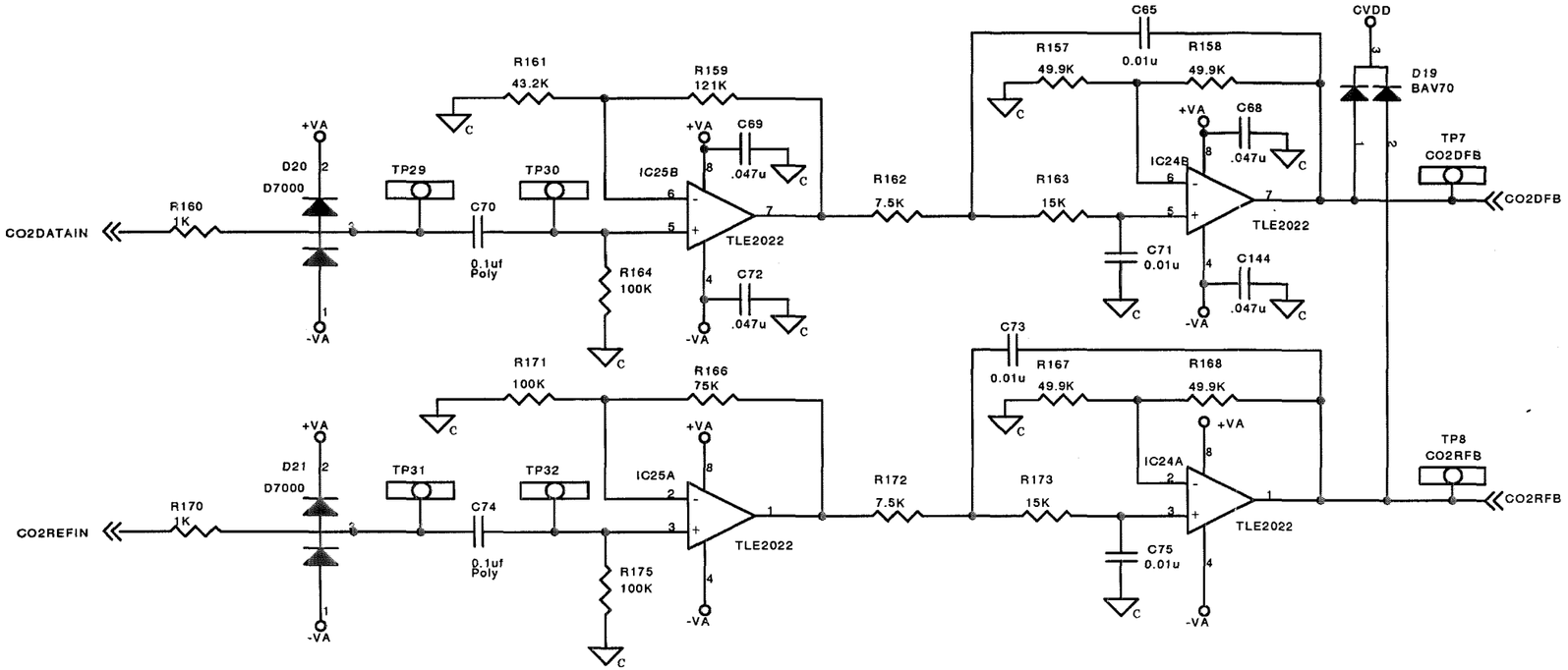
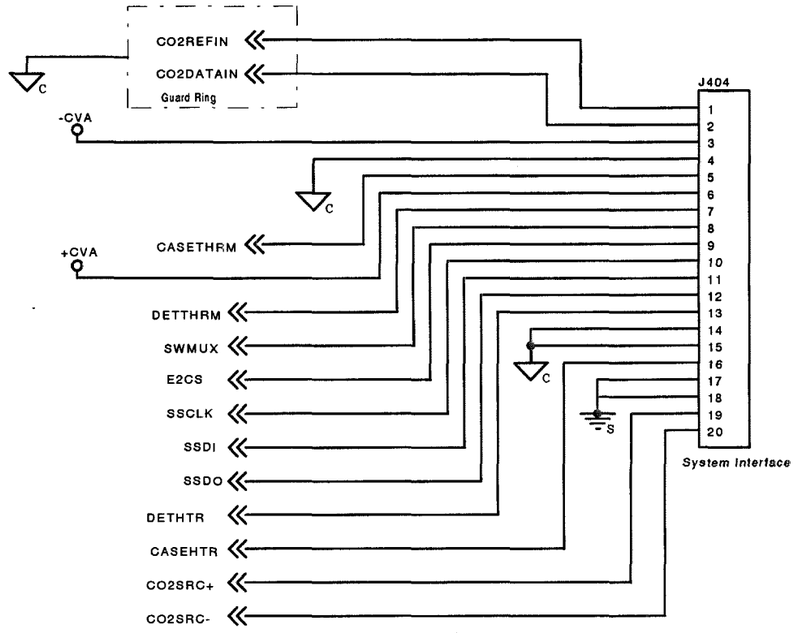
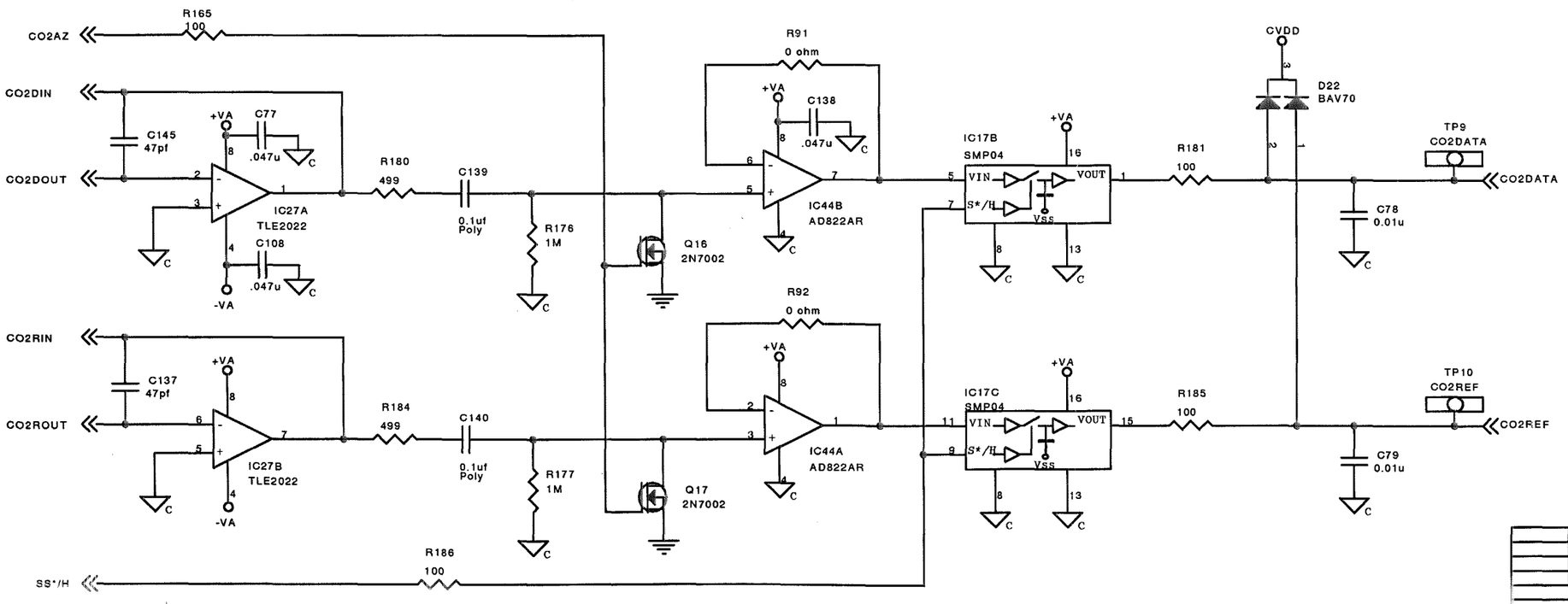
CVDD
D12
BAV70
C44
0.01u
2CVREF
R125
49.9K
R124
100K
+VA
C46
.047u
VHTR
C47
.047u
VHTR
R126
24.9K
CVDD
D13
D7000
R127
49.9K
IC20A
R128
100
IC21A
CASETHRM
R129
20.5K
TLC2272
2CVREF
LM393
C50
0.01u
R131
3.32K
R132
33.2K
R134
100K
R135
2.2M
R136
100
CASEOT
VHTR
C51
.047u
IC22B
TC1426
C53
0.01u
R137
499
CASEPWM
VHTR
D14
D7000
C43
0.1u
R122
2.49K
R123
2.49K
C45
.047u
CVDD
C42
.047u
R121
4.99K
IC19A
TLC2272
TP3
CO2CASE
CO2CASE
VHTR
C48
10u
Tant
25V
C49
.047u
R130
100K
Q10A
Si9947
Q11
2N7002
CHARDOT*
R133
1M
Q12
2N7002
Q13A
Si9947
L7
220uH
TP4
CASEHTR
CASEHTR
D15
MBRS140T
C52
220u
Elect
35V
C54
.047u
2CVREF
R143
49.9K
C57
0.01u
R144
100K
VHTR
R145
24.9K
CVDD
D16
D7000
R146
49.9K
IC20B
R148
100
IC21B
DETTHRM
R149
20.5K
TLC2272
LM393
C59
0.01u
R150
3.32K
2CVREF
R152
33.2K
R153
2.2M
R154
100K
DHARDOT*
VHTR
R147
100K
Q14
2N7002
R151
1M
R155
100
DETOT
Q15
2N7002
VHTR
D18
D7000
IC22A
TC1426
C62
0.01u
R156
499
DETPWM
R140
4.99K
C56
0.1u
CVDD
IC19B
TP5
CO2DET
CO2DET
R141
2.49K
R142
2.49K
C58
.047u
TLC2272
Q10B
Si9947
Q13B
Si9947
L14
220uH
TP6
DETHTR
DETHTR
D17
MBRS140T
C60
220u
Elect
35V
C61
.047u

			MODEL 610 MAIN BOARD		Novametrix	
					Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492	
			Drawn: A.Esposito 3 May 96	Checked: ML 4-10-97		
03	N519	10-21-97	Mfg Eng: MJC 4-10-97	Approved: AJE 4-10-97	Size B	Document Number 2738 / Code 03 / Rev 03
02	N486	7-14-97				
01	N471	5-20-97	File: SCHEMATIC1		Sheet 4 of 7	
Rev.	"R" No.	By Date	Date: Tuesday, October 21, 1997			





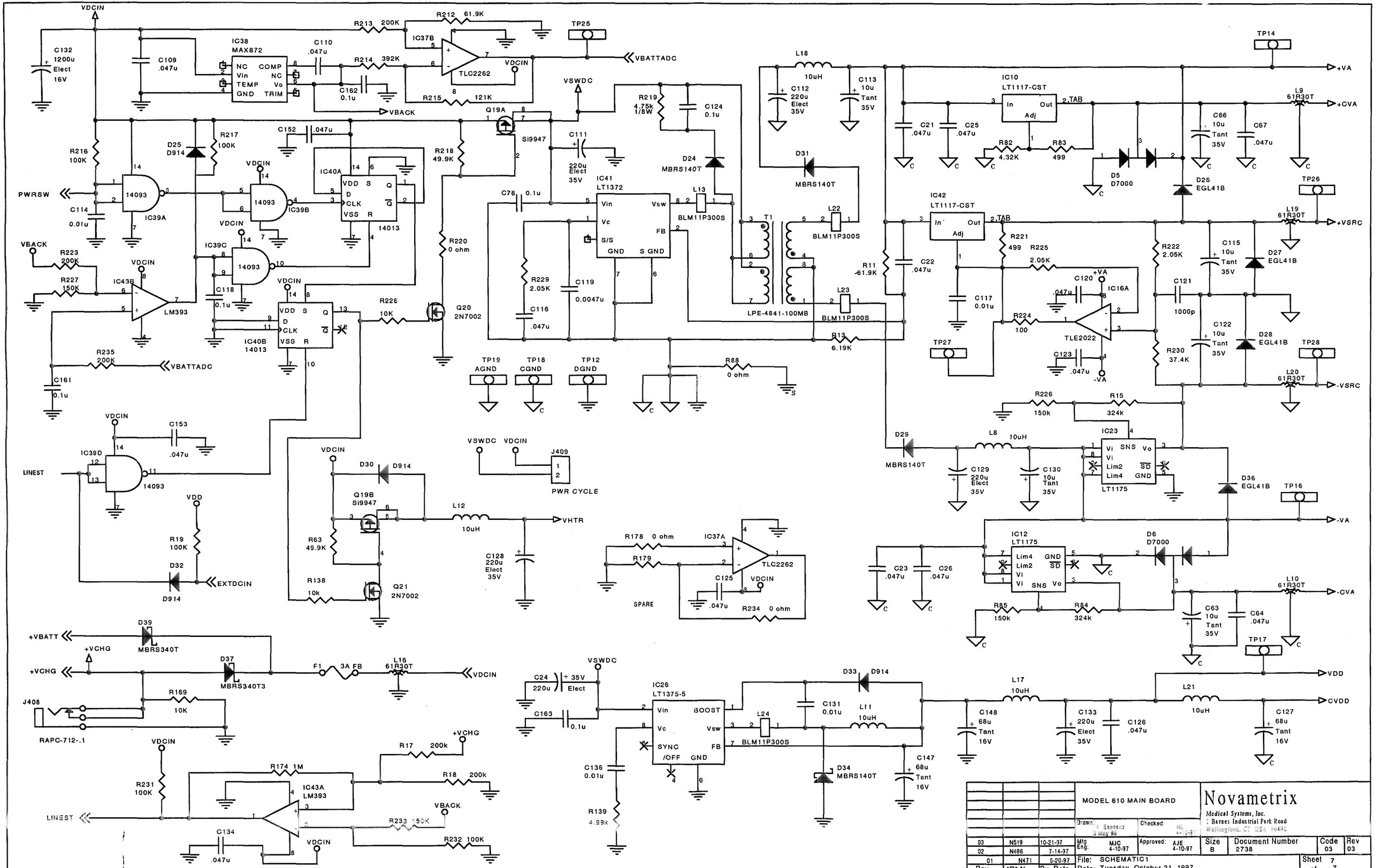


NOTE:
1.) UNLESS OTHERWISE SPECIFIED:
RESISTANCE VALUES ARE IN OHMS 1/16W, 1%
CAPACITANCE VALUES ARE IN FARADS
INDUCTANCE VALUES ARE IN HENRY'S
2.) LAST REF DES USED:
C164, D41, F1, IC45, J409, L24, LS1, Q22,
R238, S1, T1, TP33, VR1, Y1
3.) DO NOT POPULATE THE FOLLOWING:
C157A, C158A, C159A, J402, J405, R179

			MODEL 610 MAIN BOARD		Novametrix		
					Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492		
			Drawn: A.Esposito 3 May 96	Checked: MJC 4-10-97			
03	N519	10-21-97	Mfg Eng: MJC 4-10-97	Approved: AJE 4-10-97	Size B	Document Number 2738	Code 03	Rev 03
02	N486	7-14-97						
01	N471	5-20-97	File: SCHEMATIC1				Sheet 5 of 7	
Rev.	"R" No.	By Date	Date: Tuesday, October 21, 1997					

IC28
AD680
TP TP VO NC TP VIN TEMP GND
R187 10
+VA
C81 .047u
C86 .047u
C87 10u Tant 25V
R190 10K
R191 10K
C88 0.01u
C89 .047u
IC30A
TLE2022
R192 100
TP21
R193 10K
2CVREF
CVREF
C90 4.7u Tant 10V
C91 0.01u
IC30B
TLE2022
R194 100
C92 4.7u Tant 10V
TP22
R196 10k
R200 10k
R197 4.99K
VREFO/2
C94 0.01u
IC32B
TLC2272
R201 100
C96 4.7u Tant 10V
VREFO/2
C98 .047u
IC31B
AD822AR
C99 0.01u
IC34 1220A-015A-3N
C100 0.01u
R
VDD
C80 .047u
C82 0.1u
IC29
LTC1384CSW
C1+ C1- C2+ C2- TR1IN RX1OUT TR2IN RX2OUT RX /EN VCC V+ GND V- RX1IN TR1OUT TR2OUT RX2IN ON/OFF*
C83 0.1u
C84 0.1u
C85 0.1u
ASTxD
ASRxD
COMMPWR
VDD
D38 D7000
VDD
D35 D7000
+VCHG
L15 61R30T
D41 MBRS340T3
R237 10K
J406
Battery
R188 1K
R189 1K
RxD
TxD
J407
COMM
RxDLS
TxDLS
VR1 1K
R195
R198 499
IC33 AD620
C95 .047u
C102 .047u
-VA
R203 75K
R204 75K
C97 0.1u
R199 150K
IC31A
AD822AR
C101 .047u
R202 100
CVDD
D23 D7000
TP11 ABPRESS
ABPRESS
CVDD
IC36 AD7564
C105 .047u
C103 10u Tant 25V
VDD DGND SDOUT CLR LDAC FSIN SDIN CLKIN A1 A0 RFBA RFBB VREFC VREFD AGND VREFA IOUT1A IOUT2A VREFB IOUT1B IOUT2B RFBC IOUT1C IOUT2C RFBD IOUT1D IOUT2D
SRST*
DACLD*
DACCS*
SSDO
SSCLK
CO2DIN
CO2DOUT
CO2RIN
CO2ROUT
TOUT1
CO2DFB
CO2RFB
TOUT
-2CVREF
C106 .047u
C143 0.01u
IC45A
TLE2022
R211 33.2k
R183 10K
2CVREF
R182 10K
C141 .047u
IC45B
TLE2022
C142 .047u
-VA
TP23
-2CVREF
TP24
CVDD
R207 24.9K
R208 33.2K
R209 10K
Q18 T2907A
VDISP
R210 100
IC35B
TLE2022
-VA
C160 0.01u
R205 24.9K
R206 10K
D40 D914
LS1 AT-09
C104 .047u
IC35A
TLE2022
R90 100
Q4 3904T
TOUT
AUD_EN
R89 100
Q22 2N7002
C107 .047u
-VA
+VA
R87 10

			MODEL 610 MAIN BOARD		Novametrix
					Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492
			Drawn: A.Esposito 3 May 96	Checked: ML 4-10-97	
03	N519	10-21-97	Mfg Eng: MJC 4-10-97	Approved: AJE 4-10-97	Size B / Document Number 2738 / Code 03 / Rev 03
02	N486	7-14-97			
01	N471	5-20-97	File: SCHEMATIC1		Sheet 6 of 7
Rev.	"R" No.	By Date	Date: Tuesday, October 21, 1997		



			MODEL 610 MAIN BOARD		Novametrix		
					Medical Systems, Inc. 1 Barnes Industrial Park Road Wallingford, CT USA 06492		
			Drawn: A. Espadas 3 May 96	Checked: MJC 4-10-97			
03	N519	10-21-97	Mfg Eng: MJC 4-10-97	Approved: AJE 4-10-97	Size B	Document Number 2738	Code 03 / Rev 03
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01	N471	5-20-97	File: SCHEMATIC1				Sheet 7 of 7
Rev.	*R* No.	By Date	Date: Tuesday, October 21, 1997				

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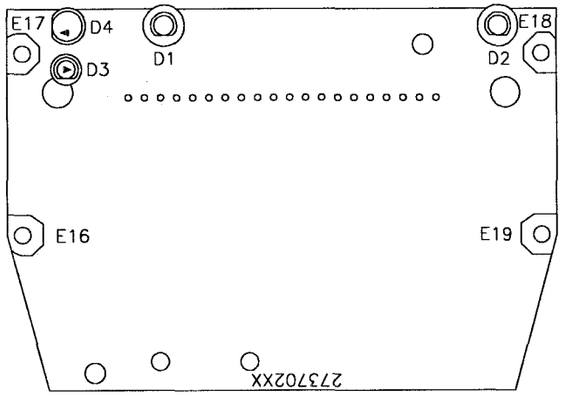
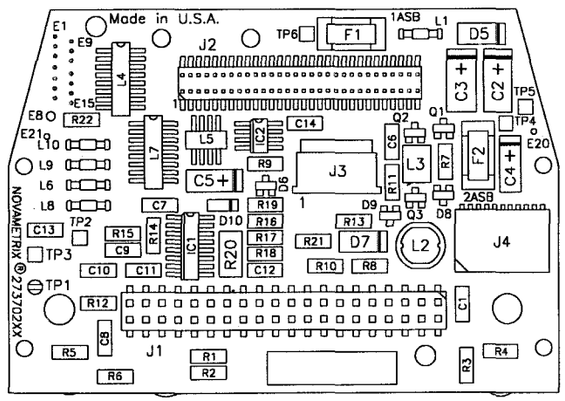




PN	DESCRIPTION	REF DES
2737-02	FAB, INTERFACE BOARD, 610 - TIDAL WAVE	~
D2737-03	SCHEMATIC, INTERFACE BOARD	~
154072	CAPACITOR, .1uF, 50V, 10%	C1, C6-C11, C14
154078	CAPACITOR, 1000pF, 50VDC, 10%, NPO	C12
154079	CAPACITOR, 10uF, 16V, 10%, TANTALUM	C4, C5
154093	CAPACITOR, 68uF, 16VDC, 10%, TANTALUM	C2, C3
180022	INDUCTOR, 10uH, 10%	L3
180030	INDUCTOR-CAP, 4700pF, 50VDC, 2A, 3 TERMINAL	L1, L6, L8-L10
180034	FERRITE FILTER, 4 LINE, EMI SUPPRESSION	L5
180035	FERRITE FILTER, 8 LINE, EMI SUPPRESSION	L4, L7
180046	INDUCTOR, 18uH @ 2.5M Hz, +25% -15%	L2
☆ 211514	CONNECTOR, 5 PIN, HEADER, RT ANGLE, .1 SP	J4
☆ 211639	CONNECTOR, 6 PIN, RCPT, SIDE CABLE, .05 SP	J3
☆ 213411	CONNECTOR, 40 PIN, RCPT, PASS THRU, DIL, STR	J1
213900	CONNECTOR, 60 PIN, HEADER, .05 X .1 SP	J2
☆ 216029	TEST POINT, SPRING LOADED, 475' C MAX	TP1
280233	SPACER, LED, FOR 2 LEADS, .2 DIA X .1 LONG	(FOR D4)
280234	SPACER, LED, FOR 3 LEADS, .255 DIA X .185 L	(FOR D1, D2)
280235	SPACER, LED, FOR 2 LEADS, .25 DIA X .2 LONG	(FOR D3)
474136	RESISTOR, 1k OHM, 1/8W, 1%	R7, R11, R18
474161	RESISTOR, 5.9k OHM, 1/8W, 1%	R16
474170	RESISTOR, 301k OHM, 1/8W, 1%	R17, R21
474174	RESISTOR, 332k OHM, 1/8W, 1%	R1-R6
474182	RESISTOR, 150k OHM, 1/8W, 1%	R10
474220	RESISTOR, 0 OHM, 1/4W, 5%	R12, R22
474263	RESISTOR, 28k OHM, 1/8W, 1%	R15
474277	RESISTOR, .15 OHM, 1/2W	R20
474278	RESISTOR, 237k OHM, 1/8W, 1%	R8
474279	RESISTOR, 562 OHM, 1/8W, 1%	R9
474280	RESISTOR, 243 OHM, 1/8W, 1%	R13
474281	RESISTOR, 71.5k OHM, 1/8W, 1%	R14
474282	RESISTOR, 4.64k OHM, 1/8W, 1%	R19
481045	DIODE, ZENER, BZT52-C5V1, 5.1V	D10
481546	DIODE, MMBD914L, SWITCHING	D6, D8, D9
481549	DIODE, MBRS140T3, RECTIFIER	D5, D7
☆ 482601	LED, YELLOW, ROUND, .100 SPACING	D3
☆ 482602	LED, GREEN, ROUND, .100 SPACING	D4
☆ 482603	LED, BICOLOR, RED/YELLOW, ROUND, 3 LEAD	D1
☆ 482604	LED, BICOLOR, RED/GREEN, ROUND, 3 LEAD	D2
483020	TRANSISTOR, FMMT717, PNP, SOT23 CASE	Q1
484060	TRANSISTOR, MMBT3904T, NPN	Q2, Q3
486042	IC, AT93C66-10SC, SERIAL 4k EEPROM, 8 PIN	IC2
486820	IC, BQ2004SN, FAST CHARGE, 16 PIN	IC1
515085	FUSE W FUSEHOLDER, 2A, 125V, SLO-BLO	F2
515087	FUSE W FUSEHOLDER, 1A, 125V, SLO-BLO	F1

NOTES:

1. D2737-01 SPECIFICATIONS:
   A. COMPONENTS NOT FITTED: C13
   B. ☆ DENOTES THRU HOLE COMPONENTS.
   C. TRIM COMPONENT LEADS FLUSH WITH PC BOARD.

REV	R NO.	DATE

DO NOT SCALE
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (mm)
BREAK ALL SHARP EDGES
TOLERANCES
DEC ± ~ (mm) (± ~)
FRAC ± ~ (mm) (± ~)
HOLES +.007 -.003 (mm) (± ~)
ANG ± ~
MATERIAL ~
FINISH ~

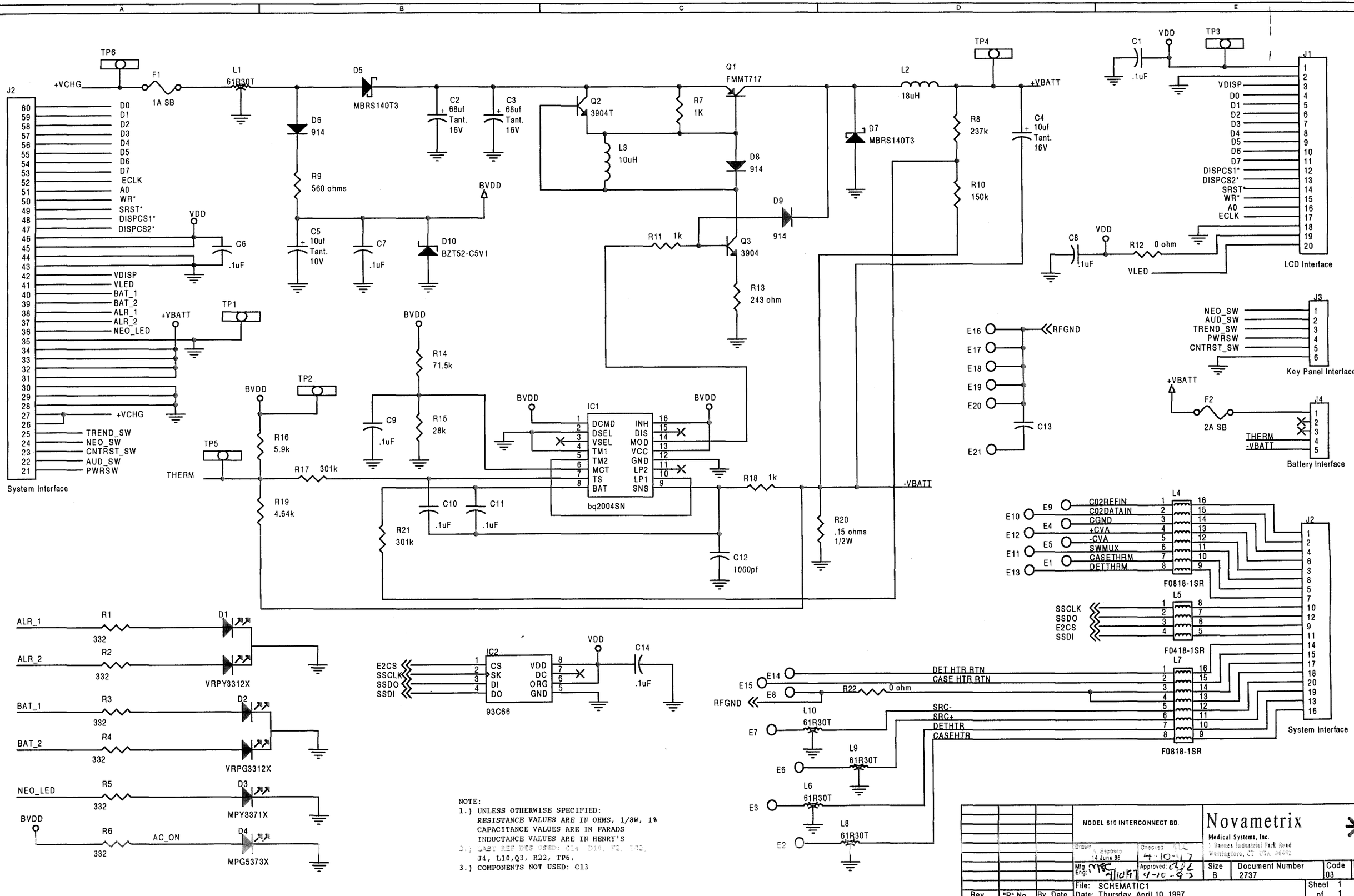
TITLE: INTERFACE BOARD ASSY, MODEL 610 - TIDAL WAVE

DRAWN BL 17Jan97
CHECKED MRF ZAQUIN
MFG ENGR
APPROVED
USED ON: 06854-01

NOVAMETRIX MEDICAL SYSTEMS INC.
WALLINGFORD, CT U.S.A. 06492

SIZE	DRAWING NO.	CODE	REV
D	2737	01	00

SCALE: 2/1 SHEET 1 OF 1


TP6
+VCHG
F1
1A SB
L1
61R30T
D5
MBRS140T3
C2
68uf
Tant.
16V
C3
68uf
Tant.
16V
Q1
FMMT717
Q2
3904T
R7
1K
L3
10uH
D8
914
D9
914
L2
18uH
TP4
+VBATT
D7
MBRS140T3
R8
237k
R10
150k
C4
10uf
Tant.
16V
D6
914
R9
560 ohms
BVDD
C5
10uf
Tant.
10V
C7
.1uF
D10
BZT52-C5V1
VDD
C6
.1uF
R11
1k
Q3
3904
R13
243 ohm
J2
D0
D1
D2
D3
D4
D5
D6
D7
ECLK
A0
WR*
SRST*
DISPCS1*
DISPCS2*
VDISP
VLED
BAT_1
BAT_2
ALR_1
ALR_2
NEO_LED
+VCHG
TREND_SW
NEO_SW
CNTRST_SW
AUD_SW
PWRSW
System Interface
TP1
+VBATT
TP2
BVDD
R16
5.9k
TP5
THERM
R17
301k
R19
4.64k
R14
71.5k
C9
.1uF
R15
28k
IC1
DCMD
DSEL
VSEL
TM1
TM2
MCT
TS
BAT
INH
DIS
MOD
VCC
GND
LP2
LP1
SNS
bq2004SN
R18
1k
-VBATT
C10
.1uF
C11
.1uF
R21
301k
C12
1000pf
R20
.15 ohms
1/2W
C1
.1uF
TP3
J1
VDISP
D0
D1
D2
D3
D4
D5
D6
D7
DISPCS1*
DISPCS2*
SRST*
WR*
A0
ECLK
LCD Interface
C8
.1uF
R12
0 ohm
VLED
E16
E17
E18
E19
E20
E21
RFGND
C13
J3
NEO_SW
AUD_SW
TREND_SW
PWRSW
CNTRST_SW
Key Panel Interface
+VBATT
F2
2A SB
J4
THERM
-VBATT
Battery Interface
E9
E10
E12
E11
E13
C02REFIN
C02DATAIN
CGND
+CVA
-CVA
SWMUX
CASETHRM
DETTHRM
L4
F0818-1SR
E4
E5
E1
L5
SSCLK
SSDO
E2CS
SSDI
F0418-1SR
L7
F0818-1SR
E14
E15
E8
RFGND
DET HTR RTN
CASE HTR RTN
R22
0 ohm
SRC-
SRC+
DETHTR
CASEHTR
E7
E6
E3
E2
L10
61R30T
L9
61R30T
L6
61R30T
L8
61R30T
System Interface
R1
332
ALR_1
D1
R2
332
ALR_2
VRPY3312X
R3
332
BAT_1
D2
R4
332
BAT_2
VRPG3312X
R5
332
NEO_LED
D3
MPY3371X
BVDD
R6
332
AC_ON
D4
MPG5373X
IC2
CS
SK
DI
DO
VDD
DC
ORG
GND
93C66
E2CS
SSCLK
SSDO
SSDI
VDD
C14
.1uF
NOTE:
1.) UNLESS OTHERWISE SPECIFIED:
RESISTANCE VALUES ARE IN OHMS, 1/8W, 1%
CAPACITANCE VALUES ARE IN FARADS
INDUCTANCE VALUES ARE IN HENRY'S
2.) LAST REF DES USED: C14, D10, F2, IC2,
J4, L10,Q3, R22, TP6,
3.) COMPONENTS NOT USED: C13
MODEL 610 INTERCONNECT BD.
Novametrix
Medical Systems, Inc.
1 Barnes Industrial Park Road
Wallingford, CT USA 06492
Drawn: A. Esposito 14 June 96
Checked: 4-10-97
Mfg Eng:
Approved:
Size B
Document Number 2737
Code 03
Rev 00
File: SCHEMATIC1
Date: Thursday, April 10, 1997
Sheet 1 of 1
Rev.
"R" No.
By Date